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Classification of Faults and Fractures Into Series and Sets and Its Practical Application.†

BY F. JULIUS FOHS.*

The difficulty of classifying the faults and fractures of a section so that such classification shall be of practical value, has long been felt in every mining field where complex faulting has entered into the question of the location of ore deposits; and, as such regions are the most common *loci* for ore and mineral deposits, the question is of prime importance. Usually the best that can be done is to classify the faults and fractures, as having a northeast or northwest strike. Miners have locally given arbitrary names to the more usual strikes; such are used in the Erzgebirge of the Harz and other German mining regions,[1] but outside of implying the direction of faults or fissures already found, they serve no practical purpose.

In the study of the veins and faults of western Kentucky, I became convinced as early as 1902, that rather definite relationships exist between the strikes of faults or fractures, and their crosses. For instance, it was noted in widely separated sections of the district, that fractures bearing N. 35 deg. to 40 deg. E. would have crosses bearing N. 20 deg. to 25 deg. W. Again, those bearing N. 20 deg. to 25 deg. E. would have crosses of N. 35 deg. to 40 deg. W., etc. Still others were found in such regions as variant angles to those formed by those given; as for example in the Columbia Mines section, in Crittenden County, where the last mentioned bearings obtain, fractures bearing N. 10 deg. to 15 deg. E. were noted. Such being the case, use was made of the relationships noted by me in various sections of the field without any attempt at their reduction to a common relationship.

Shortly afterward, I saw Hobb's work on the faults of the Pomperaug Valley, Connecticut.[2] Hobbs had noted somewhat similar relationships. He attempted to explain the formation of the courses of a set, by constructing parallelograms having 150 and 300 ft., respectively, for sides, and by using a number of these in different combinations, to arrive at the different courses.

It was not until very recently that I conceived the idea of a common relationship between members of a set of fractures, having accidentally arrived at it in working up the data in hand relative to the structure of Western Kentucky, for presentation in the reports. It was noted in the field work, that, almost constantly, close approaches to 60 and 90 deg. for angles formed between joints and their crosses, obtained, both in sandstones and limestones; this gave the clue. Burke obtained the angles of 59 deg. and 121 deg. for joints in a great many instances in the same field.[3] Upon tabulating in three sets, the northwesterly courses most usually found in the field, using a range of 70 deg., and adding respectively 60, 90 and 120 deg., the members, grouped under the three remaining series, north-northeast, east-northeast and west-northwest, were obtained for each set and these found to agree remarkably with the strikes of crosses observed in the field.

Upon measurement of the angles formed by the fissures shown upon the map of the Freiberg district,[4] similar angles were closely approached in a great many instances, both for fissures of the same type and for those of other types where they crossed each other. Angles closely approaching 60 deg. and 90 deg. formed by three sets of fractures, were found in the plate of a specimen of jasper from Minnesota, shown by Leith to exhibit fracture cleavage.[5] The latter is typified by regions where normal faulting has produced fault block structures.

With these data at hand, the following rule was deduced; this to be applicable to exokinetic tension fractures, especially where tension is dominant as the result of flexure, and possibly to all types of tension fissures: Upon adding 30 deg. to, or subtracting it from, northeast courses (according as they may be north-northeast or east-northeast) will give the corresponding northeast course; for the northwest courses, add and subtract 60 deg from the north-northeast course; or; having the north-northwest course given, add 60, 90 and 120 deg., and obtain the the other three; while if the west-northwest be given, the north-northwest may be obtained by subtracting 60 deg. Such bearings may be readily obtained instrumentally, by constructing an equilateral triangle, using either the north-northwest, the north northeast, or the west-northwest, as a basal side; the remaining two sides will then give the bearing of the other two, while a perpendicular dropped on the north-northwest side will give the east-northeast bearing.

Often only two members of a set are obtained, though usually a third is present, and less often a fourth. In the Kentucky-Illinois district, a north-northeast and a north-northwest, with usually one of the other two, are to be found, depending somewhat on what part of the field one is in. The predominance is to be explained upon the basis of previous strains producing lines of least resistance. In the Kentucky-Illinois district such lines are offered by the crossing of two monoclinal folds, forming a fan-like fold, previous to the application of the forces resulting in fissures and faultings.

Variations from the angles named are to be expected, the amount of variation being dependent largely on the extent of homogeneity of the rock. the variation increasing as the extent of homegeneity decreases. A maximum variation of ten deg. might obtain, though in most instances it will be less than five degrees. In any one section of a district, one or more sets may prevail, and the presence of more than one set may be assumed when two fractures are found with courses forming an angle largely variant from the constants given.

The most probable explanation that presents itself, as to why the directions assumed by fractures should bear constant relations to each other, so as to permit their grouping into sets, may be stated thus: Consider a fault zone as a beam, in

† Abstracted from forthcoming reports on "Livingston County, Its Mineral Veins and Other Resources," and "The Lead, Zinc and Spar Deposits of Western Kentucky." Published by permission of the director of the Kentucky Geol. Survey.

* Assistant geologist, Kentucky Geol. Survey.

[1] "The Nature of Ore Deposits," Dr. R. Beck; trans. by W. H. Weed, Vol. I, p. 116, 1905.

[2] "The Newark System of the Pomperaug Valley, Conn.", by W. H. Hobbs, Pt. III, 21st Ann. Report, U. S. Geol. Survey, pp. 7-162.

[3] W. E. Burke, The Mineral Industry, Vol. IX, p. 294; 1901.

[4] Map accompanying "The Nature of Ore Deposits," Dr. R. Beck—trans. by W. H. Weed, 1905.

[5] *Bull.* 239, C. K. Leith, U. S. Geol. Survey, facing page 194; 1905.

which a tension stress has been induced at an acute angle to the axis of the beam. Where tension is set up, shearing results, at an acute angle to the direction in which the force is applied. Theoretically, the angle of maximum shear made at right angles with the applied stress, is 45 deg. for both compression and tension. Practically it appears to be less for compression, and greater for tension. Hodgekinson obtained 35 deg. as an average for compression of twenty-one cast-iron cylinders; while Kircaldy obtained 65 deg. with the axis of tension for tensile stresses in steel. Allowing 5 deg. in the latter instance for variation of character and homogeneity of material acetd upon, we have a close correspondence with the angle secured in the field.

Modifying somewhat the statement presented by Hoskins,[6] as to the production of fissility by compressive stress, we have the following:

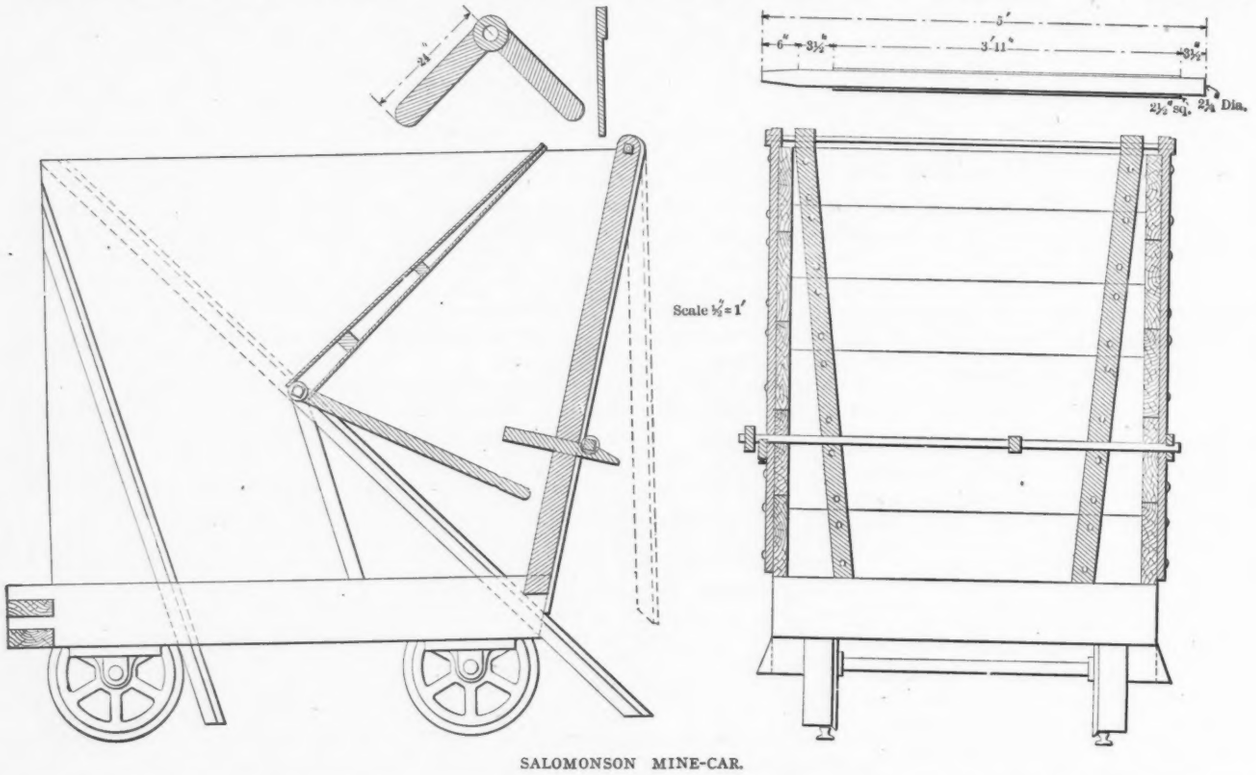
Where rocks are subjected in volume to the forces of compression or tension, in case of the former the angles formed by shears, would be at an average angle of 5 deg. or 35 deg., such average still to be determined; while where tension is the dominant stress, an approach to angles of 60 deg. may be anticipated. In such a case, two sets of planes of rupture may develop, cutting each other at an oblique angle, the greatest pressure bisecting the acute angle, for compressive stresses; and cutting each other at an acute angle, the greatest stress bisecting the oblique angle, for tensile stresses. The latter corresponds with the two right-angles formed between the first and third and the second and fourth members of a set, the angles cutting each other at the acute angle of 30 deg. While such rupture will probably not occur in regular manner throughout large volumes, considerable regularity holds for limited volumes, producing approximate parallelism of fault planes.

Such strike sets become equally applicable to the joints, larger fractures and faults, and fracture and faults zones, the variation becoming somewhat greater as applied to increased volume. While the course pursued by fault zones, where *en echelon* fractures obtain, is at an acute angle with the course of the major fractures along it, crossing fault-zones maintain somewhat similar relations, the angle being swung in the same direction. With the course of the fault zone known, allowance may be made for this difference of angle, and the course of the constituent fractures may be determined.

The number of sets of bearings found in a district will depend upon the number of directions from which a force has been exerted. A number of complex conditions may enter in fixing the general trend of each series in different districts

Where evidence of a fracture or fault exists, with the direction indeterminable, this may be approximately obtained thus: Determine the bearings of joints of rock-outcrops in the vicinity. The member having a strike most nearly coincident with that of the major fractures of that section will most probably approach that of the fracture, whose strike is to be determined; or where conditions suggest a different strike, it will approach that of the one of the three corresponding members, of a set (constructed as indicated above) which comes nearest filling the given conditions.

It has been the practice heretofore to cross-cut at right angles in both directions from the strike of a fracture or fault so so as to cut parallels or semi-parallels. Where cross fractures also enter the problem, this is inadequate. With the constant relations between the cross-fractures known, it resolves itself into a simple matter to determine the direction necessary for the smallest amount of cross-cutting to locate all possible fractures. For exokinetic tension fissures, cross-cutting in four directions at an acute angle of 30 deg. with the strike of the fracture would fill these conditions.



SALOMONSON MINE-CAR.

[6] "Flow and Fracture of Rocks as Related to Structure," L. M. Hoskins, 16th Ann. Rep., U. S. Geol. Survey, p. 873, 1896.

The International Congress of Applied Chemistry.

The next meeting of this congress will be held in Rome, Italy, from April 30 to May 3, 1906. As is well known, the sessions of this cosmopolitan association for applied chemistry have been steadily gaining in attendance, interest and influence. As usual, special facilities and courtesies are to be offered by the local government in transportation and hospitality. All communications should be addressed to the office of the congress, 89, via Panisperna, Rome. The subscription fee is 20 lire ($4.00).

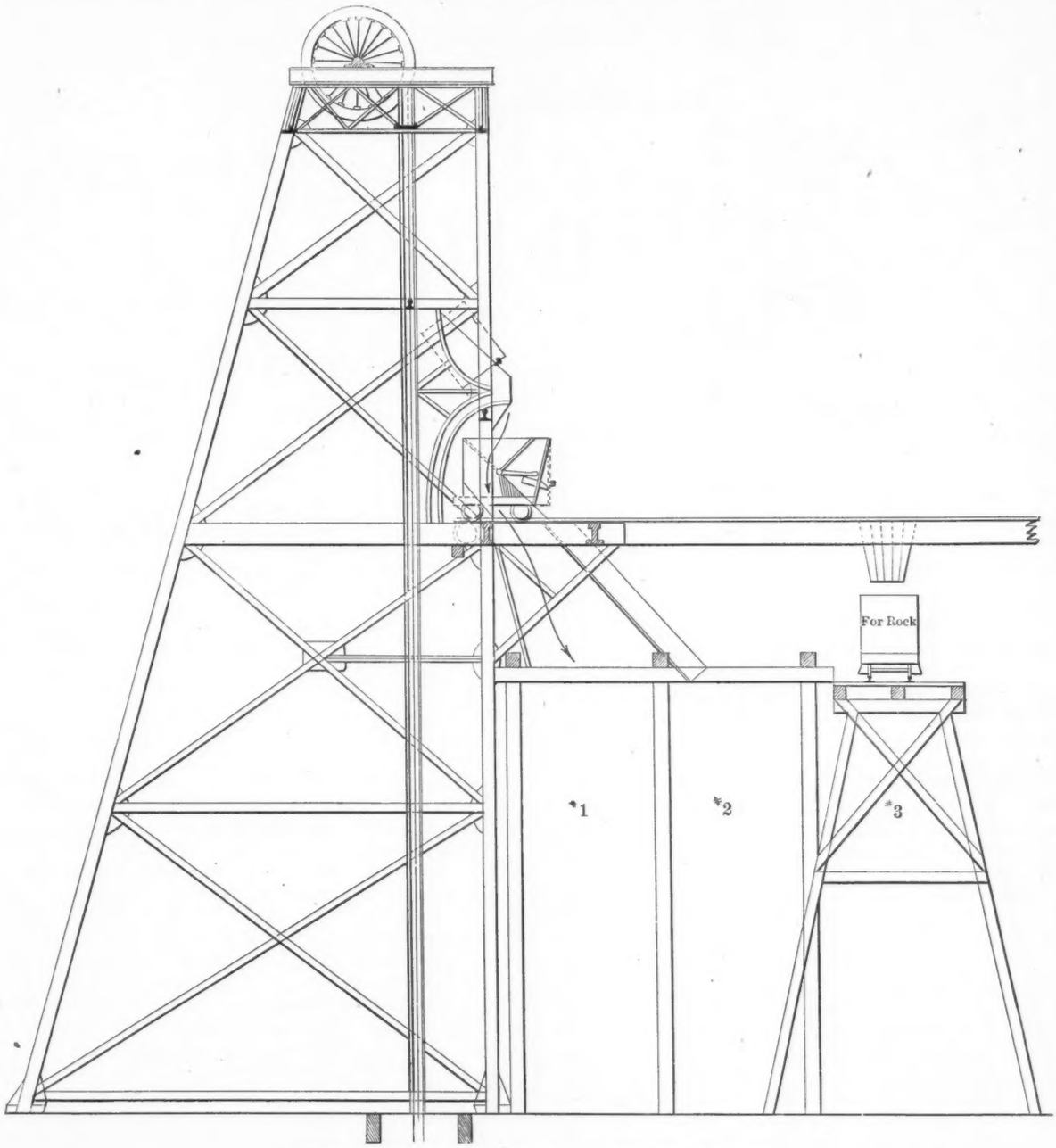
The Salomonson Mine Car.

BY D. E. WOODBRIDGE.

At No. 4 shaft of the Aragon mine, Norway, Mich., three grades of material are hoisted; two of ore, and rock. In order that these shall be handled at the surface without delay, H. Salomonson, master carpenter of the mine, designed a novel car, that is shown in the accompanying illustrations. Movable aprons, operated by hand or power, have been and are still used at many Lake mines having similar conditions; but the Salomonson device has been quite successful at Aragon and has now been tried there some time, being considered an improvement.

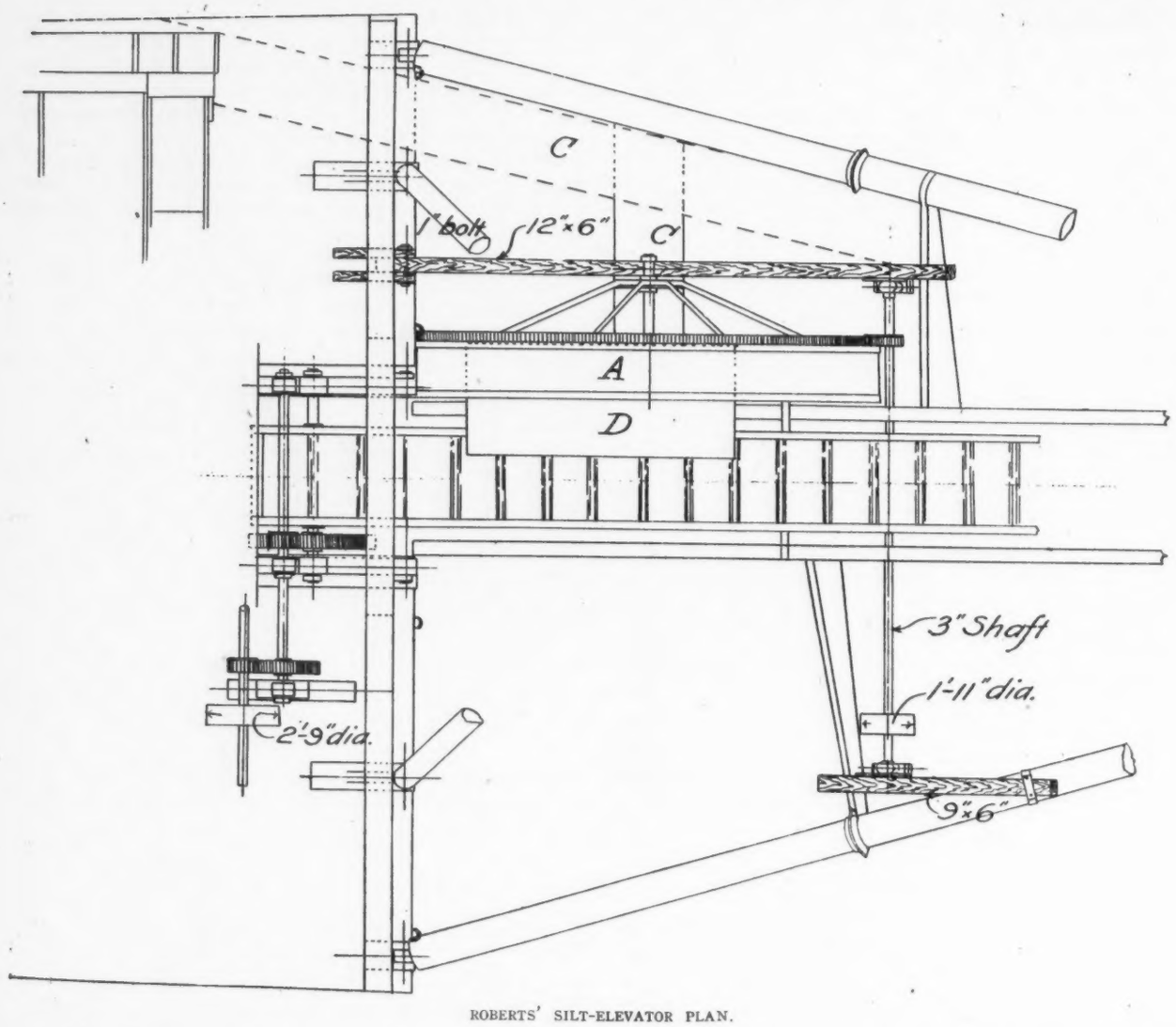
The large drawing shows No. 4 headframe, with skip dumping ore destined for No. 1 pocket. The car is built with a transverse diagonal partition, the upper half of which is hinged, so that when thrown forward it makes the rear portion of the car a chute, and shuts off the forward part. In dumping to the pocket directly beneath the skip, this partition is thrown forward and the ore passes unobstructed through. No. 2 pocket, for another grade, is further out from the skip; when the signal from below indicates that ore for this pocket is in the skip, the movable partition is replaced in natural position, the end door is opened, and the car is a chute having another discharge. In case a third class of material is coming up, and is to be dropped in a third bin, or run to a dump or car, as shown in the drawing, the car is closed, the diagonal partition placed so that the entire car can be filled, and the car used as an ordinary tram.

In brief it is an ore-dumping tram-car having an open bottom, and with a center partition so arranged that either the rear or front portion may be closed at will.



DEVICE FOR GRADING ORE AT NO. 4. SHAFT, ARAGON MINE.

Fossil meal is manufactured from kiesel-guhr, and should contain 90 per cent. silica. The peculiar hollow form of these microscopical small shells gives to kiesel-guhr its high porosity and, consequently, its high non-conducting power.



ROBERTS' SILT-ELEVATOR PLAN.

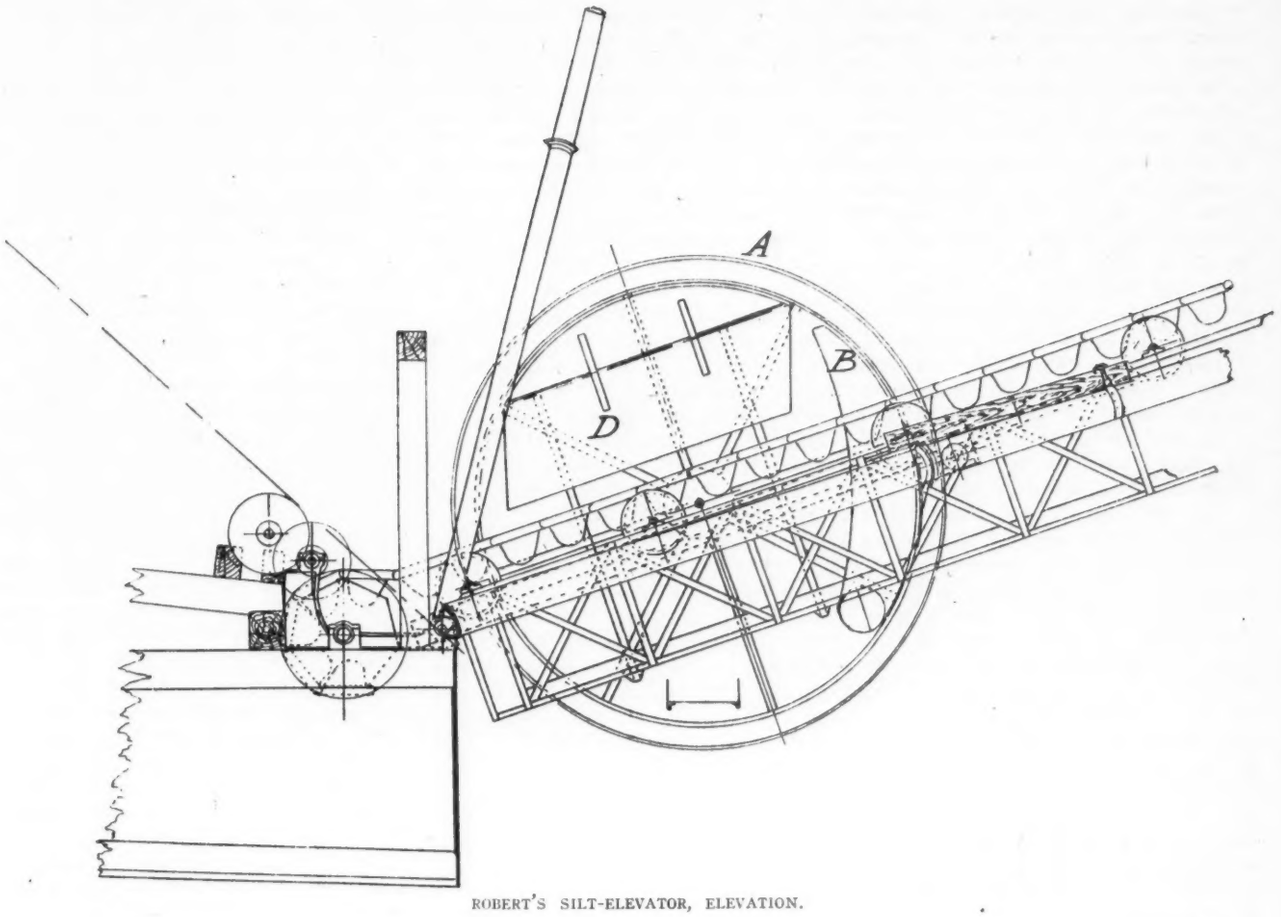
Robert's Silt-Elevator for Dredges.*

This elevator was designed to obviate the great wear and tear which takes place with the ordinary bucket or "baby" elevator originally introduced by Edward Roberts, of Dunedin, on the dredge "Moa," at Alexandra, which has been largely adopted by other engineers. It is well known that any piece of machinery having a number of separate parts working in sand, or water heavily charged with sand, quickly wears out, and this has been the case in a marked degree with silt-elevators on dredges. Roberts early foresaw this, and in 1899 patented the wheel-elevator, claiming in the patent to receive the sand in any manner at the bottom of the wheel, and discharging it at the top, so that the wheel would be adapted for dipping material from a trough or receiving it direct from the sands-shoots, as in the plan illustrated. The latter plan is for many reasons the better, principally because there is no friction from moving the wheel through a body of sand and water, and the wheel may be stopped at any time without any danger of silting up and the breakage consequent on the restarting of the wheel.

In the design illustrated (which is similar to the wheels used on the Golden United, Sullivan's Lead, and Golden Run dredges), the wheel *A* is fixed in a framework alongside the main elevator, and is capable of being raised and lowered with the elevator-frame. It is driven by gearing and belting from the main elevator countershaft, and runs at a slow speed. The wheel-rim is formed trough shape with internal buckets. The sand and water from the tables being delivered by the sand-shoot *C* into the lower part of the wheel, and the wheel, revolving at a sufficient speed, the mixture of water and sand is taken away as fast as it is delivered from the sand-shoot, and there is consequently no boiling. It is then carried up slowly, the sand settling in the buckets and the surplus water being caught off the lips of the buckets by a collector *B* having suitable vanes and delivering the water at the bottom into the paddock. By the time the buckets reach the top of the collector the last of the water is discharged and the sand begins to deliver on the apron or shoot *D*, sliding down this shoot into the main elevator-buckets in a continuous stream. There are no moving parts except the wheel and shaft, and no wear. The wheel also, being suspended freely, and having no parts in frictional contact with the material, can be of very light construction.

* From "Papers and Reports relating to Minerals and Mining," New Zealand, 1905 (Government report), p. 16.

A singular dispute has taken place between D. Stewart & Co., engineers, Glasgow, and the Heckmondwike Urban District Council in regard to water-tube boilers. The boilers, when erected, conformed to the specifications in every detail; but the complaint was that they would not evaporate as required. A Manchester expert stated that the difficulties experienced were due to want of draft and bad coal, and the absorption of the heat by the brickwork, which, if the brickwork had been hot, would have gone into the boiler.—*The Engineer*, London.



ROBERT'S SILT-ELEVATOR, ELEVATION.

Goldfield and Tonopah.*

BY H. H. TAFT.†

The tuffs (andesite) of this district probably lie upon limestone, elsewhere identifid (*e. g.*, at Bullfrog) as Cambrian. On the southwest side of Columbia mountain is an outcrop of dark limestone, evidently overflowed by eruptives. In the Tonopah Club claim the ore is a siliceous sedimentary that has the appearance of limestone, through which gold-bearing solutions have percolated and left enough of the precious metal to make it possible to sort out some shipping-ore.

The country-rock shows more mineralization than in the southern district and has been much more disturbed since the mineral deposition. There are three large intrusions of alaskite (quartz and alkali feldspar rocks) and a great many dikes of a green rock, probably decomposed trap, which is closely associated with the original andesite. Standing upon one of the intrusions, Vindicator mountain, one can see, both from the workings and the color of the country-rock, that the mineralized area takes the form of a ring. It is yet a question whether the central part will prove of value or not. Outside, the field is completely surrounded by more recent tuffs, overflowed on the west side by dark basaltic lava, which forms a mesa some 4 miles square between Goldfield town and Montezuma mountain.

The topography presents simply hills with higher hills or low mountains around them, except to the north, which opens out to the San Antonio desert. Montezuma mountain (altitude 8,000 ft.) is 8 miles west. The old Montezuma lead-silver district is on the west slope of this mountain. The castings in the 10-stamp mill and 36-in. water-jacket furnace bear the date of 1886. At Lida, a boiler front recently re-set was cast in 1866.

A very prominent geological feature is the reefs of silicified country-rock, usually called rhyolite dikes, found all over the district, but more numerous to the south and east. They are sometimes very large (50 ft.), but generally about 10 ft. thick; and they extend in all directions without regularity, frequently crossing each other. They are sometimes 2,000 or 3,000 ft. long, and again but a few feet, and exhibit all grades of silicification. On the surface they are hard and flinty; but underground away from the weather, the rock although harder than the andesite, which is quite soft, is not bad for drilling. The phenomenon of blackening so noticeable in the desert and recently described by Prof. Blake, is very apparent.

The gold was deposited by successive flows of water in or near these reefs, as was the case with the dikes at Victor, Colo., but there are exceptions, as in the Velvet and Tonopah Club claims. Again as at Cripple Creek, one often hears that the country-rock shows value, and not the veins. At the surface the gold is very free and is fine in both grain and grade. Below the zone of oxidation, the ores are not yet thoroughly understood. There is probably considerable difference in the different properties. It is now certain that tellurides are present; but the principal accompanying mineral is, as usual, pyrite. Although there is no copper-stain near the surface, there is considerable gray copper at depth. There is rather more antimony than arsenic, but both are present.

It is too early to say what will be the solution of the metallurgical problem. The low-grade ores, of which so little is known now, may be more simple in their composition. The Combination Mines Co. has provided plates, concentrators and a cyanide plant.

It is not at all easy to find the small rich streaks and lenses of ore that have given Goldfield its celebrity, and there is as yet no incentive to develop the low-grade or milling-ores, which will later be

* From advance proofs (subject to revision) of the *Transactions* of the American Institute of Mining Engineers.

† Mining engineer, Denver, Colo.

the important ones. The charges for freight and treatment are now $32 per ton.

The Jumbo was sampled many times and "turned down." It was bonded and a shaft was sunk, with no results. On the Quartzite, a shaft was sunk and trenching done, and the property was given up. On November 10, 1902, H. Stimler and W. A. Marsh camped at Rabbit Spring, where Goldfield now gets its water, and soon after made locations in the Sand Storm section. In the spring of 1904, the Sand Storm and Kendall claims were carefully explored, with no results. In the Jumbo, gold was found by panning the soft rich country-rock close to the reef which was rich; but the vein was found later *in* the reef, through which it takes a zigzag course.

After the incorporation of the Jumbo Mining Co., leases were let for the last seven months of 1904 according to the custom of the district, in blocks 200 ft. long by the width of the claim, royalties being set at 25 per cent. of the gross yield. These leases yielded over $1,000,000. The best piece of ground, 200 ft. long and 200 ft. deep, yielded in round figures 2,000 tons of $350 ore and 3,000 tons of $50 ore. The Quartzite and the Sand Storm are now among the active shippers. One lot of 14.5 tons from the Kendall claim of the Sand Storm group, yielded on the plates of a stamp-mill $45,785, and is said to have left tailings valued at $1,000 per ton.

The Combination Mines Co. is the only corporation in the district that is carefully preparing for regular future production. Good buildings are under erection, a pipe-line has been laid 10 miles to a spring, and a well-built mill has been completed. The principal vein is parallel to that of the Jumbo. Just to the NW., on a cross-vein, is the January, which has a dump of several thousand tons of milling-ore awaiting treatment. The Florence mine, one of the best, is on another cross-vein E. of the Combination. This group of four mines is the most important in the district.

Four miles north of Goldfield town is Diamondfield, about 1 mile N. of which occurs another group of promising mines from which some shipments have been made. One of these is the Black Butte, a prominent topographical feature. On this property has been developed ore of probably the lowest grade ($20) mined in the district. A short distance north, on the slope of the butte, is the Quartzite "fraction," one of the most promising properties now shipping ore. Half a mile N. is the Vernal, which has also shipped some ore. To the northwest are two very strong quartz-reefs, in which very limited prospecting has not yet developed any important ore bodies.

The explorations near the Sand Storm, 3 miles W. of Diamondfield, and a little further from Goldfield, have not been specially fortunate, except in the Tonopah Club, which is in the low ground between Diamondfield and the Sand Storm.

Northeast of Goldfield town some important discoveries have been made; and ore has been shipped, notably from the St. Ives, a claim covering a very prominent reef near the Jumbo, and from Cimerone. The latter was found during the summer of 1904, and the finder literally camped on it, putting his tent and bed over the rich place, until he had succeeded in buying the fractional claim from the original locator. Then he made the discovery public, and, in a few weeks, sold out, it is said, for $60,000 cash.

In March, 1905, the town of Goldfield, lying between the Combination mine and the mesa at the foot of Montezuma mountain, had an estimated population of 10,000, and Columbia, practically an extension 1 mile NW., had 2,000 and Diamondfield about 500. Goldfield and Columbia are supplied with excellent water by two 2-in. pipe lines. The water comes from under a mesa immediately west. The Combination Mines Co. has a pipe-line from the Warm Springs. Twenty miles west of Goldfield is the Silver Peak marsh where there is an open lake.

Both at Bullfrog and at Goldfield the situation is somewhat discouraging. In March last, scarcely 50 men were working at Bullfrog, and about 200 at Goldfield. While actual development was thus neglected, the industry of transferring to new corporations groups of claims good, bad and indifferent, of selling the stock of such corporations, was active. All American mining districts have passed, and will doubtless hereafter pass, through such a period.

The veins in the Tonopah district are much stronger and more condensed and possess the regularity of silver-veins which they should be deemed to be, since the values are about two-thirds in that metal. The railroad has been in Tonopah only a year, and has been overwhelmed by freight for the newer districts. One small mill, owned locally, is operating; the owners of the developed properties do not seem to think that the time is yet ripe for large reduction-plants.

About 1,500 tons of high-grade ore are shipped weekly to the smelters, and incidentally an enormous amount of milling-ore is blocked out. It is said that one company has $35,000,000 in "positive ore." In one of the mines 60 ft. thickness of $28 ore is reported. The maximum depth reached is 1,000 feet. This district has therefore long passed its doubtful stage.

The country-rock is andesite, so overflowed by more recent volcanoes that very little of it is exposed. The explorations of the past year have gone through this overflow and found ore by drifting in the "mineralized porphyry" below.

The development of milling, always an expensive and interesting problem, will be unusually so in these three districts. Their ores, though different, are all typically milling-ores, consisting of quartz with very little base metal. Should smelting be necessary, there are several flux-producing districts, now idle, which could be drawn upon.

Gold-Antimony Ore Treatment.

H. L. Herrenschmidt (French Pat. 349,980, June 11, 1904) states that mixed ore containing gold and antimony, according to one process, is placed in an autoclave with substances capable of giving (by reaction in presence of water on boiling under pressure) sodium sulphide or calcium sulphide. Or, the ore is boiled in the open with the same reagent, with or without previous roasting. If, however, the ore is roasted, it may be treated either with sodium sulphide or with sodium hydroxide. The antimonial solution obtained may be precipitated by sulphurous acid to recover the antimony; the gold in the ore thus purified is recovered by cyaniding or other suitable method.

For some time a service of bats propelled by engines worked from producer-gas plants has been in operation on German canals. These boats carry a dead-weight cargo of 240 tons on a draft of 6½ ft., and the engines, which are of the horizontal type, drive a single screw to give a speed of 3½ miles per hour against the heavy currents of the Rhine between Cologne and Rotterdam. The gas producer is placed forward of the engines. The engines, which are of 80 to 100 horse-power, have four horizontal cylinders placed opposite each other, bringing the crank shaft in the center line of the boats; and an ingenious arrangement is applied for the reversing of the four blades of the propeller to give ahead or astern motion. Eleven boats are fitted with the system, with engines ranging up to 100 brake horse-power. They are also largely used in Holland. The consumption of anthracite coal is only 1.32 pound per horse-power per hour, and, taking everything into consideration—first cost, interest, depreciation, lubrication, fuel, wages, etc.—the expenses work out at about one-eighth of a penny per ton mile.

Electric traction is being applied on a large scale on the Tetlow Canal, one of the principal canals in Germany. A large central station for supplying the current has been erected. It contains a 400 horse-power dynamo and engine and two large steam turbine and dynamo sets of 700 horse-power each. Electric locomotives and the overhead system will be used.

Richard Trevethick, the father of the high-pressure steam engine, was born on April 13, 1771, in the parish of Illogan, Camborne, Cornwall.

Notes on Dutch Guiana.

BY E. H. TEATS.

The Guianas, in common with all the other auriferous countries of South America, are sharing the attention of mining investors; a constant and material annual increase in the gold output is largely responsible for this circumstance, The Guianas have become prominent as producers only during recent years; in this they differ from most of the other South American countries which had a maximum output several hundred years ago, soon after their discovery and occupation as Spanish provinces. In common with California, the discovery of gold is comparatively recent; it took place in 1876.

Geography—The Guianas, British, Dutch and French, are bounded on the south by Brazil, on the east by Brazil and the Atlantic Ocean, on the north by the Atlantic Ocean, and on the west by Venezuela and Brazil. They lie between 2 and 8 degrees north latitude, and between 52 and 62 deg. west longitude. Dutch Guiana, or Surinam, lies between the British and French colonies and has Dutch colonial administration. Paramaribo, the capital of the colony, is situated on the banks of the Surinam River, about 20 miles from the ocean. This river is navigable to the city piers for steamers of 20 to 25-foot draft. The population of Paramaribo is 35,000 to 40,000; to this may be properly added about 10,000 imported Chinese, Javanese and Indian coolies (who work on the plantations), and the native Indians and "bush niggers," none of whom are included in the census. The capital is nicely laid out, and by the variation of tide in the river, it is possible to flush the sewers twice a day; this insures a healthful condition. It has several botanical gardens and good drives. A number of clubs (of which one typical of the tropics is located on the banks of the Surinam River, with its park, dance pavillion, bowling alley, restaurant, etc.) offer comfortable relaxation, while enjoying the ocean breeze, listening to the government military band, or dancing to its accompaniment. Several good hotels and boarding houses furnish satisfactory meals and accomodations, at the rate of about $2 per day. Schools and places of worship are numerous and well attended.

Physical Geography—Most of the sur-

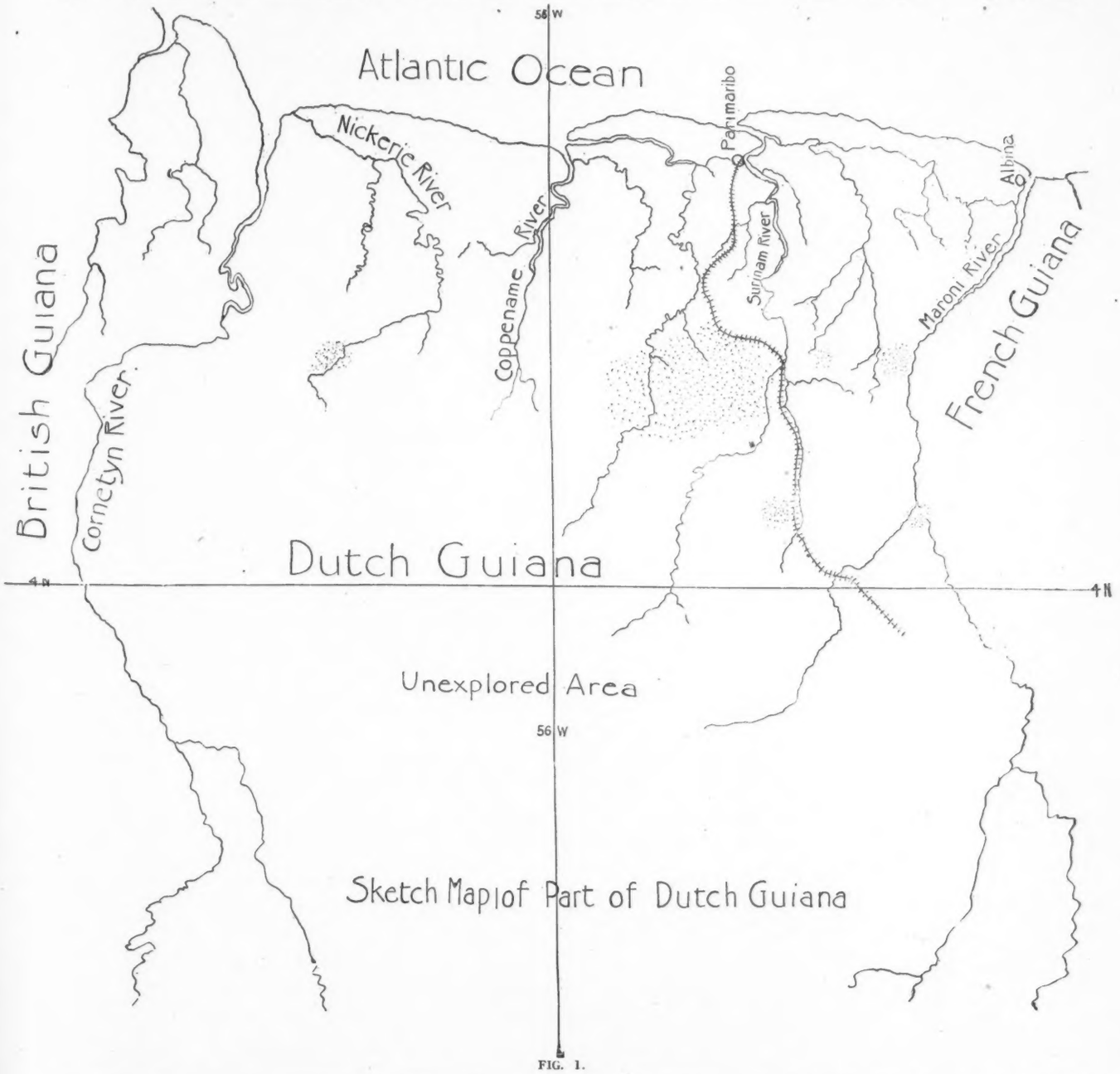


FIG. 1.

face of Dutch Guiana is but little above sea level and consists of wide fertile savannahs, separated by low flat-topped hills well rounded by erosion. Numerous water courses, all discharging into the Atlantic, make a drainage system of many tributaries but of inconsiderable length.

Climate—The climate is not unpleasant. It is nearly always warm, and subject to few changes in temperature, the range being 70 to 90 deg. F. In the "bush" or goldfields, the thermal range is from 55 to 88 deg. F. Earthquakes and hurricanes are unknown; thunder storms occur, but no damage is done by lightning. The little rainy season lasts during December and January; the big from April to July, inclusive. The death rate is about 28 per 1000 of all the inhabitants.

On one mining property, during more than two years, over 100 men were employed on an average without any deaths. Several white men from temperate zones were among them. Such circumstances indicate that care of sanitary conditions, under supervision of one realizing its importance, has excellent results in a climate erroneously suppposed to be unhealthful. Indeed, a general misconception exists as to the health conditions of Dutch Guiana; that a few men have died while engaged there is true; but, in nearly every case, recklessness or excess which would have had a similar fatal result in other countries, has been responsible.

Transportation—Both foreign and domestic communication is maintained by water. From 11 to 28 days is necessary to reach the coast from New York, depending upon the line. Stern-wheel steamers ascend the river to the limits of navigation. Small boats needing from 3 to 25 days to cover 50 to 135 miles (portages being necessary), are used on the shallow streams Freight rates to the cost from New York are about $4 per ton; and $3 to $4 per ton is charged for shipment 100 miles inland.

The Government is building a broad-gage railroad destined to penetrate the goldfields to the borders of Brazil. About 60 miles is now in operation, and construction is being pushed as rapidly as possible to finish the 160 miles now under way. This length will reach the interior where many of the large producing gold, rubber and timber concessions are located. The railroad will lessen time and cost of transportation very materially. Besides the Royal Dutch West India fortnightly service, a number of steamship lines touch at Paramaribo; and the Government line conducts a passenger, mail and freight service with Georgetown, the capital of British Guiana. A close connection is made with the Royal Steam Packet Company, with the Quebec, and other lines. A local service is also maintained between the coast ports.

Mining Laws—Mining concessions are granted for a period of forty years. The tax on concessions is as follows:

For the first two years 4 cents gold for each 2½ acres.

For the second two years 10 cents gold for each 2½ acres.

For the remaining 36 years 20 cents gold for each 2½ acres.

Taxes must be paid promptly each year in advance, but it is not compulsory to work mines continuously. Some changes, limiting the acreage acquirable, have been made recently; the new laws refer only to concessions granted since its passage. As compared with other mining countries with which the writer is familiar, the mining laws of Dutch Guiana are superior. The Government exercises a direct supervision, thereby preventing all chance of conflict as to titles; its strict vigilance over the production, transportation and disposition of gold eliminates, almost entirely, any possibility of loss by dishonesty. The Government tax on gold is a little less than 5 per cent. of the total production. There is no duty on mining machinery, and duties on food stuffs and other commodities are reasonable. The Government policy is such as to encourage the investment of foreign capital.

Labor and its Regulations—There is a law requiring contracts between employer and employee for a stated number of days of actual work, and such contracts are enforced by the government. Wages are practically $1 per day. Labor can be divided into three classes: The British, Dutch and French "niggers" (they prefer being called "niggers"). The Britisher, because of his superior education, is the most skilled and best mechanic. The Dutch, or Surinamer, prides himself on his ability as a gold digger, employing in his work, primitive methods with battea, longtom and sluice. He very rarely attempts to work ground that does not run better than $5 per cu. yd. Many of the French make the best wood-workers and general-utility men. French and English niggers are of such efficiency as to permit their employment in plants where industry, reliability and mechanical skill are necessary to insure the proper care and operation of machinery.

Weekly rations are prescribed by the Government regulations and are as follows: 6 lb. rice; 2 lb. flour; 1 lb. salt beef; 1 lb. salt pork; 1½ lb salt fish; 1½ lb. split peas; ¼ lb. leaf tobacco; 1 liter molasses. These cost about 20 cents per day per man; it is not at all times satisactory. Allowing a credit for its equivalent, and the privilege of selecting and purchasing what the men prefer, gives better satisfaction. A good class of labor is available; on an average 24 out of 26 working days per month are credited to many of the men.

A day's work is defined by the Colonial mining regulations, and is as follows: For pick and shovel work in gravel, 100 cu. ft.; for pick and shovel in loam, 300 cu. ft.; for clearing underbrush, a space 20 x 300 ft.; for cutting trees, a space 40 x 150 ft.; about 1 cord of wood is cut in one day, by one man at a cost of about 80c. to $1.

Auriferous Alluvion—In all streams where metamorphic and granitic rocks are found, gold is disseminated as nuggets and dust, in the beds and on the banks of the streams. Recent developments in British and Dutch Guiana have demonstrated that gold in paying quantity is found in the hills to a depth of several meters, and that possibilities for successful hydraulicking are good. Nearly every known mining district in Dutch Guiana is rich in gold; from some of them have come yields that almost challenge belief. Governmental records, however, are indisputable. Recent exploitation has demonstrated that there are great stores of wealth only waiting the advent of capital with suitable machinery in the hands of experienced men. Frequently the question is asked: why have not the goldfields been more extensively worked? The reasons are: First, want of capital; second, lack of men experienced in mining in tropic zones; third, the exaggerated and false impressions of outside capital regarding the labor and climatic conditions.

Vein Mining—The greater part of the country is covered by dense forests and it is difficult to prospect for veins. Diorite, gabbro and quartz porphry are found in abundance in the gold-bearing districts. Where the recovery of gold has been maintained for years by longtom and sluicing methods, the tailing dumps show shale, mica-schist, clay-slate and sandstone intermixed with pieces of quartz. In the hills are found auriferous quartz boulders frequently showing visible gold. In many places veins are noticeable on the river and creek banks. From the topographic features, and, from the geologic formation exposed by nature in erosion, and by man in mining operations, it can be predicted that, with a systematic development of the quartz veins, the greatest production of gold will come. Instances of value, such as the following, are quite often reported: Thus $552 was washed from 15 lb. of quartz; many tests of the same vein, where it has been prospected for a distance of 6,000 ft., showed values never less than $18 per ton. In another test, some 50 miles away, quartz boulders found in the gravel beds, gave a value of over $12,000 per ton. I have seen over $8000 worth of beautiful quartz specimens taken from the gravel beds where many hundred thousand dollars has been produced by hand work.

This concession was under the management of the late Julius Muller, a black man, and a member of Koloniale Staten. With Mr. Muller's death, Dutch Guiana has sustained a great loss, both as a lawmaker, and as a manager. In his life of hard work, he exhibited rare business ability and virtue; his influence for good survives him.

An auriferous belt extends from Colombia and Brazil into Venezuela and the Guianas. There are numerous rich mines on this belt in Venezuela. At the Peters mine, in British Guiana, a 15 stamp mill has been in successful operation; additional 35 stamps are to be installed this year. Much credit is due Mr. Franklin T. Sutherland for the healthy condition of the enterprise which is owned by New York capitalists. A wagon road 70 miles in length, and a pier on the coast, are to be built as part of a system of improved communication. Such large expenditures vouch for the development of a large body of ore. There is reason for believing that the lode systems of Dutch and French Guiana are a continuation of those of British Guiana and Venezuela.

FLOOD PLAINS.

The first class of deposits is flood plain in character; but its auriferous content in its roughness and angularity indicates that much of it was derived from eluvial deposition (by the disintegration of gold-bearing country rock, with numerous veins and veinlets, in place). The well eroded round-top hills indicate corrasion through a long period of geologic time; the concentrates of an incalculable volume of material exists in the savannahs or flats. Much hand work with battea, long-tom and sluice, has demonstrated that there are large areas possessing characteristics such as to make them suitable for working with gold dredges.

Characteristics—Their gravel is generally free, small, sub-angular and of a gree of induration is such as not to interfere with excavating, screening, and washing, in the process of treatment by efficient dredges. Water is abundant, and at favorable level for floating dredges, in most of the areas.

Method and Apparatus for Working—Because of the short life of timber in the humid tropical atmosphere, where numerous boring insects exist, steel hulls and gantries will probably be preferable. It may be determined that wooden construction will be sufficient. Boats and launches, well painted, have lasted with few repairs for over ten years, a fair life even in temperate zones. The use of steel construction and the shallow section of gravel will not make large hulls requisite, as bucket-ladder, stacker and sluices need not be as long as is necessary in working alluvion of great depth. Thus it will be possible while building small, light (and therefore cheap) dredges to sacrifice nothing in strength, capacity and efficiency.

FIG. 2.

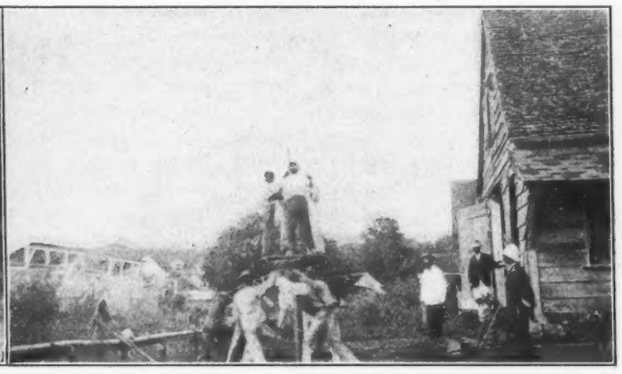


FIG. 3.

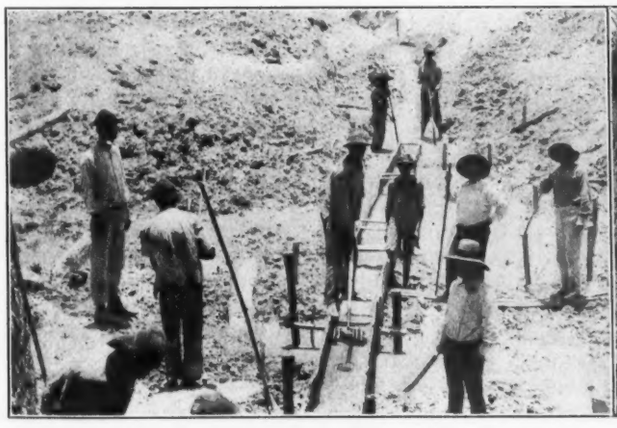


FIG. 4.

FIG. 5.

Types of Alluvion—The auriferous gravel of Dutch Guiana can be readily classified in three general types, though the lines of demarkation between two of them are not distinct. First, (and most important, because of their greater extent and richness) are the wide alluvial deposits of the river and creeks or the flood plains. Second, the low benches occurring on the hillside, at a level of inconsiderable hight above the flood plains. Third, the high terraces.

total depth varying from 6 to 30 ft., although the major portion is less than 15 ft. deep. In many districts the only overburden is the tropical growth and the underlying loam which has formed as a result of decaying vegetable matter. In other parts in addition, a clay occurs. Bed rock is generally much decomposed and of such contour as to be easily and thoroughly cleaned by dredge buckets. The occurrence of slightly cemented material, as an auriferous conglomerate, has been noticed in several instances. Its de-

A device for preventing sticky overburden from being mixed with pay gravel will be necessary in some districts. This feature will introduce no new problems, as the method is now in successful use and gives entire satisfaction (this JOURNAL, Feb. 3, 1906, p. 219). Dredge buckets will need to be of design to facilitate dis-

charging sticky material such as will be encountered in excavating overburden. It is possible that a device (such as was used in Oroville to blank the hopper and shunt the overburden into the dredge well, and thus dispose of it rapidly and simply) would work well. Fuel for steam dredges, at time of first operation, will cost about $1 per cord on the bank. This expense will increase as it becomes necessary to bring fuel from a distance. It is not improbable that coal or oil will prove cheaper when railroad communication shall have been established. There are possibilities for the installation of electric-power plants on several creeks, which feature will make the use of electric dredges advisable in some districts.

As there is a large percentage of coarse gold and large nuggets (pieces weighing 50 oz. having been found), the design of gold saving apparatus must be such as will save them. It is probable that a dredge of the sluice-box type (thus avoiding the complication of stacker and screen and having only digging and sluicing apparatus, no large boulders occurring), will work well. Dredges of particular design to suit the unusually shallow gravel will be needed. Although the conditions encountered are not difficult nor unique. a thorough appreciation of their peculiarities is indispensable to prevent the installation of machinery of unsuitable design.

LOW BENCHES.

This type occurs on the hillside but little above the general valley plains; it seems to be a continuation of the valley alluvion. In characteristics, it resembles the valley gravel, but is different in that the underlying bedrock is sloping and such as to prevent the use of floating dredges. Steam shovels, steam scrapers or other mechanical excavators would work well in these deposits where a lack of grade and dump will prevent advantageous exploitation by the hydraulic method.

HIGH TERRACES.

Gravel on the hills generally has little over-burden, and where fortunate phsyiographic conditions permit the installation of ditches to tap a supply of water, there are large possibilities for successful exploitation by the hydraulic method. The hill gravel, as shown by hydraulic operations in both Dutch and British Guiana, is sometimes over 100 ft. deep.

Conclusion—That Dutch Guiana has large certainties, larger possibilities, and great probabilities when its vein and placer deposits are contemplated, is surely true. That there are deposits of great richness is proved; there seems to be no good reason why the primitive and limited methods employing hand labor should not be displaced by new practice incorporating mechanical excavators of large capacity. A consequent large increase in the gold output will unquestionably result when the misconception of climatic and labor conditions shall have been dispelled by timely investigation.

In the illustrations given herewith, Fig. 1 is a sketch map of Dutch Guiana, with the deposits of auriferous gravel indicated by the dotted sections. The railroad under construction by the Government is also shown. Fig. 2 shows a Guiana dredge at work. Fig. 3 shows the method of prospecting area to determine the advisability of extending the railroad. This work is done by the Colonial Government, which also builds and operates the railroad. Fig. 4 shows sluicing operations. The inefficiency and lack in capacity of this method are apparent from the illustration, where two men are shown handling tailing. It is in such deposits that there are large possibilities for the introduction of mechanical excavators of large capacity. Fig. 5 pictures canoes used in the primitive transportation in vogue on the shallow unnavigable rivers. The completion of the railroad will do much to rectify this bad condition.

Mining in Ontario.*

BY PHILLIPS THOMPSON.

The notable increase in mining activity in Ontario is well illustrated in this report by the director, Thomas W. Gibson, and covering the operations of 1904. The second part of the report, a monograph, by Prof. Willet G. Miller, dealing with the Cobalt silver area, has previously been noticed at some length (the JOURNAL, Dec. 2, 1905, p. 1018); it was issued in advance of the present volume, on account of the more general interest excited by the rich discoveries in that locality. In addition to giving a general survey of the other mining industries, the report just published contains a number of special papers by geological experts embodying the results of recent explorations and researches.

The total output of the year was valued at $11,572,647; of which $4,906,677 is classed as metallic, and $6,665,970 as non-metallic. A decrease of $1,297,946, as compared with 1903, is accounted for by the closing of the plants of the Sudbury nickel field for some time, and by the also temporary cessation of operations by the Sault Ste. Marie industries.

Three metals previously wanting have been added to the list, viz., platinum, palladium and cobalt, though their production as yet is comparatively small; platinum, 536 oz., value $10,452; palladium, 952 oz., value $18,546; and cobalt 29 tons, value $36,620. The last previously recorded production of cobalt was in 1894, when 3¼ tons, value $1,500, was produced and extracted from Sudbury ores. In the process now followed, of converting low grade into high grade matte in bessemer converters, the cobalt is washed. The reappearance of this item is due to the silver-cobalt mines.

The stoppage of production during a considerable time for the installation of the new smelting plant of the Canadian Copper Co. and the suspension of the treatment of ores by the Mond Nickel Co. resulted in a marked decrease in the nickel and copper output. The nickel contents of the matte produced amounted to 4,743 tons, value $1,516,747; as against 6,998 tons, value $2,499,068, in 1903. The copper content of the matte was 2,163 tons, value $297,126; as against 4,005 tons, value $583,646, for 1903.

A marked feature of industrial activity in the Sudbury nickel district is the use of the natural water powers of the neighborhood for electric energy. Powers on the Spanish, Vermilion and Wahnapitae rivers are being developed; and the mines and works of the Canadian Copper Co. will be operated by electricity.

The financial difficulties of the Lake Superior Corporation, now fortunately surmounted, resulted in a decrease in the production of iron ore, from 208,154 tons in 1903, to 53,253 tons in 1904. The production of pig iron and steel was as follows: Pig iron, 127,845 tons, value $1,811,664; as against 87,004 tons, value $1,491,696 in 1903. Steel, 51,002 tons, value $1,188,349; as compared with 15,229 tons, value $304,580, in 1903. The market presented by the opening up of the West renders the outlook for iron and steel industries at the head of navigation on Lake Superior very favorable.

The decline in the production of gold reduced the output in 1904 to $40,000.

In the petroleum industry, a favorable reaction is noted; the output of crude petroleum rose from 16,640,338 to 17,237,220 gal. The yield of natural gas has increased in value from $196,535 in 1903 to $253,524 in 1904. The greater portion is drawn from Welland county; but a promising field is being exploited in the adjoining county of Haldimand. A special report on "Petroleum and Natural Gas" is contributed by E. T. Corkill, inspector of mines.

*Abstracted from "Fourteenth Report," (1904) the Bureau of Mines, Ontario, 1905, Part I, Pp. 355.

The manager of the Anchor tin mine, Tasmania, in a recent half-yearly report, while explaining its low working cost, points out that the tinstone in the formation is of such uneven quality that prospecting bores do little more than roughly indicate the value of the ground bored. He mentions, further, that the value of the ore in the deeper ground has been less than anticipated, and less than the bores and other tests of the shallower ground indicated.

The average gold yield of the dredges in Victoria in 1904 was 2¼ grs. (or 5d.) of gold per cubic yard, or, say, 1⅓ tons of gravel.

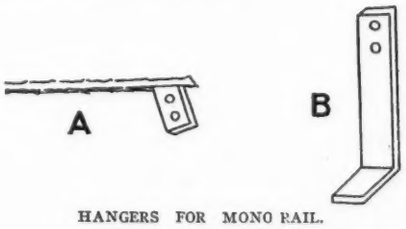
Mono Rails in Underground Tramming.*

BY WAGER BRADFORD.

About two and a-half years ago the question of the mono rail in connection with electric telpherage suggested to me the possibility of adapting it to the requirements of underground tramming. A series of experiments was then begun, which has resulted in the successful installation of a mono rail system on several levels in Langlaagte Deep. About 3,000 ft. of road are now in regular operation, in drives, cross-cuts, stopes and winzes. The system is of practical value, has possibilities which I have not yet developed, and is a radical departure from existing methods.

We are all familiar with the disadvantages of the present system of tramming. In filling trucks at the stope boxes there is always more or less spill, causing great friction; trucks frequently go off the track on account of the rock lying on it; in tipping at the shaft ore bins, unless tiplers are used, the truck body cannot turn clear over, and the ore, if wet, sticks to it, so that there is loss of time, and much wear and tear in the trucks to clear them; and finally, rails and wheels are not only continually exposed to the action of the mine water, which is often strongly acid, but are grinding, the one against the other, in this corrosive medium. With a mono rail, suspended from the roof. these troubles are minimized.

That the mono rail system can be successfully adapted to all sorts of conditions, has been fully demonstrated at Langlaagte Deep, where it is used on development work, both driving and winzing, and in tramming both in the stopes and from the stope boxes. The accompanying drawings, made from photographs recently taken, illustrate this better than any statement.



HANGERS FOR MONO RAIL.

As to cost, satisfactory comparative figures cannot yet be given. Thus far the running gear of all trucks, and all the hangers, etc., have been made at the mine, and at a cost greatly in excess of that for which they could be imported. It has taken long continued trials to prove that this or that was just right. For example, no rail suitable for a permanent road could be obtained. It should have a very deep web to give stiffness between the hangers, with a relatively narrow bead. Rails of this section are not made; the cost of rolling them specially is prohibitive; and standard bulb angles, 4½ in. deep, are now being imported as a substitute. The present roads are all equipped with 16-lb. rail; but while just the thing in a winze, this is far too light for a drive, and should be changed. Also, in the case of trucks, hangers, etc., it has taken time to arrive at the best standard pattern. It is safe, however, to predict that the erection and equipment of a mono rail will be little, if at all, in excess of the cost of the present system.

As installed at Langlaagte Deep, the mono rail road consists of vertical iron hangers firmly fixed in the roof of the drive, winze or stope, with a right angle bend 6 in. from the bottom to form a step on which is carried a 16 lb. rail. The rail is placed at the edge of the step, to allow clearance between the vertical portion of the hanger and the truck wheels, on the one side, and between the bridle of the suspended truck and the edge of the step, on the other.

The hangers are made in two parts (hereinafter designated as A and B) to allow for adjustment in bringing the rail to grade. The A, or upper part of the hanger, which is attached to the roof, is made in two styles, one for drives and cross-cuts, and another for winzes and stopes.

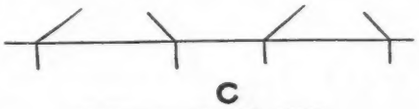
For drives it is made of inch square iron, pointed at one end, ragged at the corners, and with a flat wing welded in an inch from the other end, at an angle of about 135 deg. Two holes are drilled through the wing to bolt on the B or lower part of the hanger. For winzes and stopes, the A hanger is made with shorter shank and of lighter iron, and the wing is welded in at right angles to the shank. The B or lower part of the hanger is made of 1 x 4 in. flat iron, bent, as stated, 6 in. from the bottom, at right angles, with two holes drilled through the 6 in. arm to bolt the rail to, and two near the end of the long arm to bolt to the wing of the A hanger.

To attach the hangers to the roof of a stope or winze, horizontal hand holes are drilled to the depth of the shank, say, 12 in. deep; in the one case at right angles to the line of the rail, and in the other parallel to it. The hole is then partially filled with dry wood strips reaching the full length, the shank inserted, wing down, and driven well home. The stress being vertical and at right angles to the shank, the hanger cannot possibly pull out.

The attachment of hangers in a drive or cross-cut is much more difficult. Here the shape of the roof and the necessity of clearance between the trucks and the side of the drive forbid side holes. The holes must run more or less in line with the drive, making it impossible to get a right-angled pull on the shank of the hanger.

Vertical holes, well plugged, would carry a dead load of several tons; but the vibration incident to tramming tends to loosen the hangers in such holes, and accordingly the holes are put in as near a right angle with the vertical as the roof will allow, and looking in turn to and from each other. Adjacent holes thus look always in opposite directions, and the possibility of a hanger pulling out is minimized.

The holes are put in with machines, are 18 in. deep, 2 in. in diameter, and approximately 8 ft. apart, and are so placed that a plumbline dropped from the centre of the hole will be 2 ft. from the footwall side of the drive. This is to ensure the truck coming nicely under the stope boxes, and to have a clear traveling road on the hanging-wall side. A mono rail in the middle of a drive, or zig-zagging from one side to the other, is a serious inconvenience. It should always be on the footwall side and as close as possible. Into the finished hole is now driven a perfectly dry and well-fitted plug of pitch pine to the full depth of the hole, and when it is "home," an inch round hole is bored in it to the depth of the shank of the A hanger from point to wing. The hanger is then driven home, wing down, the greatest care



METHOD OF DRIVING HOLES.

being taken to keep the wing in a vertical position. If this is not done the completed hanger will not be plumb. The moisture in the air swells the dry wood plug, causing it to grip the rough sides of the hole and the ragged shank of the hangers, and making the road perfectly secure.

The next step is to bolt up the B hanger, but before this can be done the exact length required must be ascertained. To find this, one end of the grade stick is placed on the last completed hanger, and the other end brought to such an elevation that the grade is just right. The distance is then measured from the bottom of the grade stick to the holes in the wing of A hanger, and on this measurement the B hanger is drilled in the shop ready to bolt up.

It is a little cheaper to punch the holes, but they are not as exact, and any variation affects the grade of the road. In new work it is best to have the man developing put in the holes as he goes along, because he can do this when rigged up ready for drilling in the face, and thus save the cost of rigging up for two 18 in. holes. From one rigging two holes can be put up with 8 ft. centers, and a man can put up from 12 to 16 holes per shift. It is also ad-

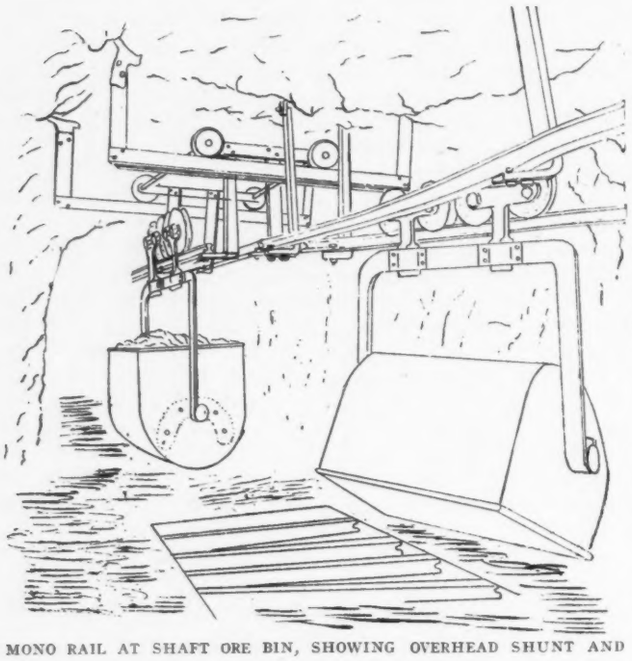
*Abstract of a paper in *Journal* of the South African Association of Engineers, December, 1905, pp. 104-115.

visable to put up box holes as the drive advances, so that they can be holed into from the stope to save the danger of blasting the mono rail when erected.

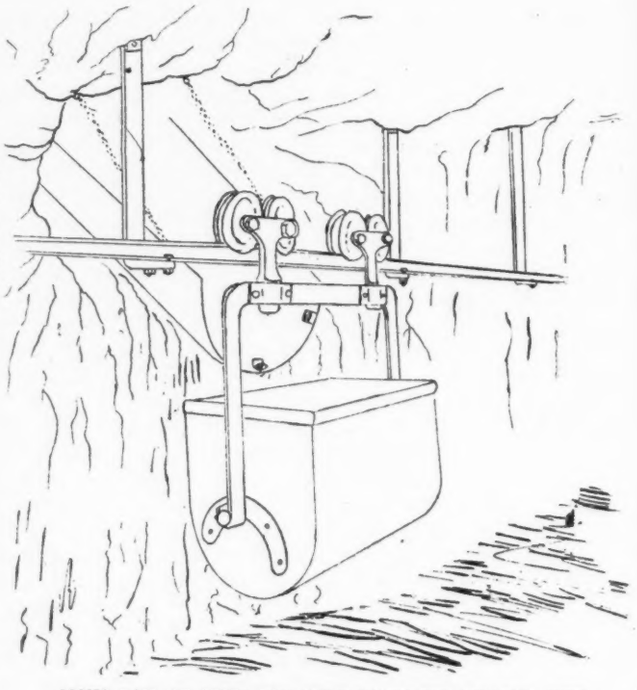
If changing over from a ground-level road to a mono rail, it will pay to have a machine mounted on a trolley to shift quickly along the drive.

The distance between the hangers is an important factor in the cost of the work. For example, 150 ft. of road would take 25 hangers 6 ft. apart, say, nineteen 8 ft. apart, and fifteen 10 ft. apart. Against the saving by wider spacing must be put the need for heavier rail and hangers, and the greater stress on each unit. This would become serious if trucks of, say, one ton capacity were used. From experience, 8 ft. centers seem about right, especially if motor traction be contemplated. It would be better in each case to distribute the load over, say, 12 half-ton trucks rather than to concentrate it in six one-ton trucks; but this does not apply to hand tramming.

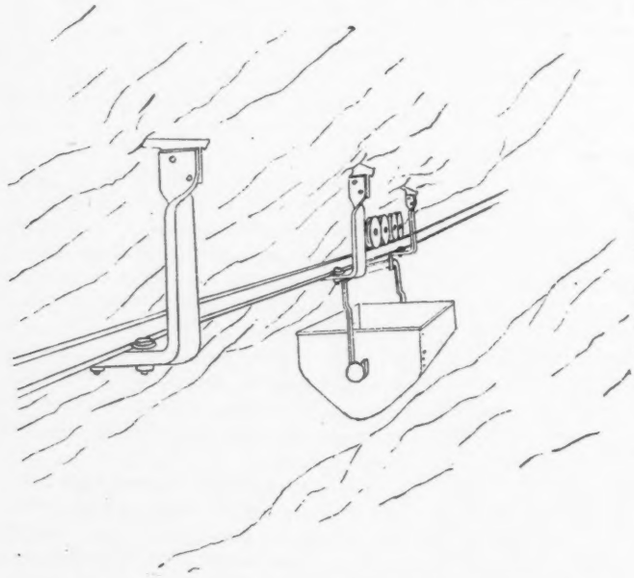
In laying the rail, care should be taken to break joints on the hanger, if possible, so that the end of each rail may have a bearing surface in addition to the fish plates. The hangers are bolted up with the step on the hanging wall side of the drive, and the rails are laid with the flange flush with the end of the step, and bolted securely to it through the flange. In the cross-cuts, where the roads from east and west converge, T hangers are used, the rails from the drive being continued on each arm of the T. If the rail were carried on the footwall side of



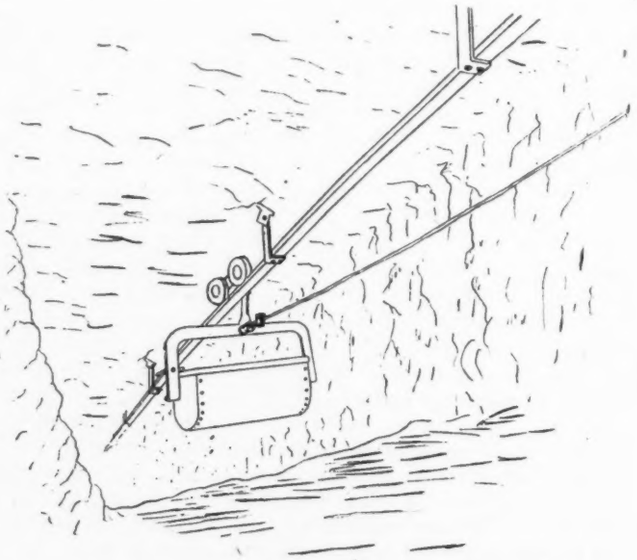
MONO RAIL AT SHAFT ORE BIN, SHOWING OVERHEAD SHUNT AND METHOD OF TIPPING TRUCK.



MONO RAIL AT STOPE BOX HOLE READY FOR FILLING. THE CHUTE IS OF STEEL PLATE ROLLED SHALLOW AT ONE END AND DEEP AT THE OTHER.



MONO RAIL IN STOPE; SPECIAL TRUCK BODY TO CLEAR FLOOR AND SAVE TAKING UP BOTTOM.



MONO RAIL IN WINZE, OPERATED BY AIR HOIST.

the hangers in the drives, this would not be possible, as the bridle and wheels of the trucks would then foul the T hangers in the cross-cut, necessitating a double line of hangers, and a wider cross-cut. In stope roads, for which the mono rail is particularly adapted, the rail may be laid on either the foot or hanging wall side of the hanger, but it is of advantage in narrow stopes to put it next the hanging, because the footway is thus brought lower down the stope, the tram boy does not have to stoop so much, and his work is thus made easier. In development work, in order to keep the road well up to the face, one or more light jack bars are set up, fitted with brackets on which to lay the rail. By this means the trucks can be got right into the face, no matter what the bottom is, and the permanent rail laid as soon as it is safe to put up the hangers.

When the roof of a drive is very high, or is unsafe, sticks of timber are easily made fast between walls to carry the hangers. The length of the rail should always be some multiple of the distance between hangers, and the longer the better.

Switches, turntables, crossings, etc., are easily managed. At one station, a view of which is given, an overhead shunt shifts loaded or empty trucks from one track to another. A simple and effective switch is also shown in one of the accompanying drawings. It consists of a short length of rail, one end of which is pivoted vertically on the last hanger before the branch, while the other end is supported by a hanger sliding on a curved strip of iron fixed horizontally in the roof of the drive. There is just enough travel to allow the loose end of the rail to swing from one branch road to the other, where it is secured, as wanted, by a sliding fish plate. This switch works perfectly, but must be moved by hand, and has the objection, that one branch of the Y is always open, so that a full truck might run through into the level. To obviate this I have designed an automatic lifting switch, but the objection to the open end is more imaginary than actual.

It is essential for easy tramming that the grade of the road shall be very even, not up and down, especially if heavy trucks are used.

The trucks consist of a U or V shaped body, hung at each end by a single pin to a bridle, which is attached, in turn, by two vertical draw bars to a pair of two-wheeled bogies. There are thus four wheels in tandem. The diameter of the wheels, and the depth of the bridle, vary according to the head room. In winzes and very narrow stopes 6-in. wheels are used, in wide stopes 8-in., and in the drives 8 to 12 in.

The wheels have a flange each side, ½ in. deep, and cut away at ¼ in. taper to give a tread at the bottom of the groove of 1¼ in. This allows ⅛ in. side play, the rail head being 1⅛ in., and prevents the wheels mounting the rail on a curve.

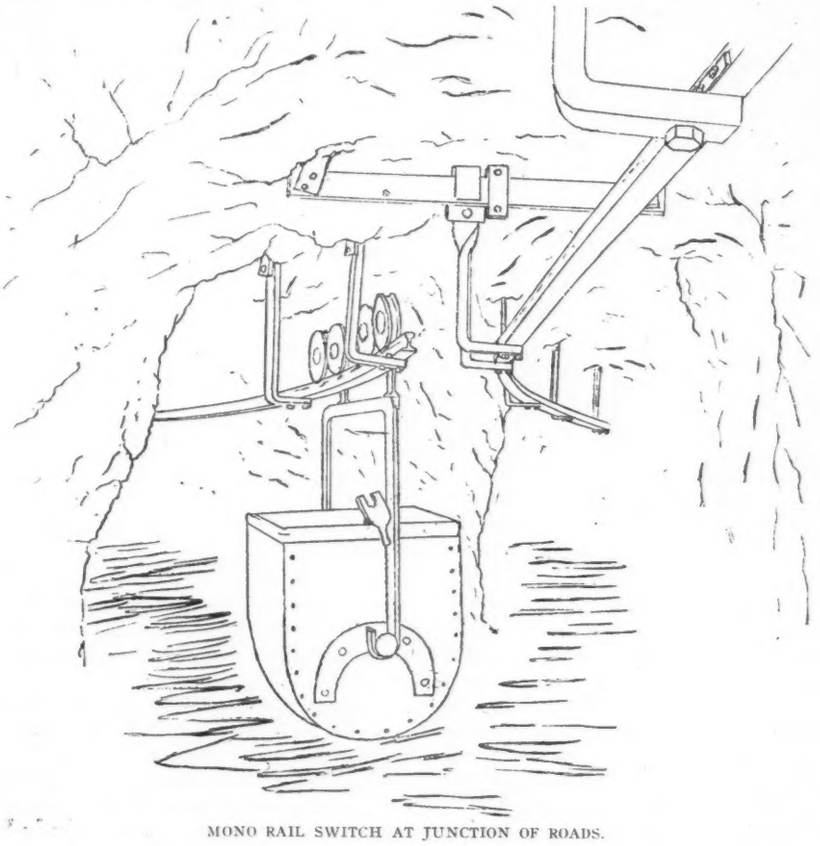
The wheel base is as short as possible, being 9½ in., with 8-in. wheels, and the bogies are set as close together as clearance will allow. The wheels of each bogie run loose on axles made fast to the bogie frame, which is welded in the centre to the draw bar, thus forming a T, of which the draw bar is the stem, with the wheels at the end of each arm. The axles are fitted with grease cups.

The vertical center line of the draw bar of each bogie bisects the wheel base, and the lower end of the bar is made round, and flanged and held to the bridle by a loose fitting clip. The weight of truck body and bridle is thus carried on the flange of the draw bars, while each bogie moves independently of the other on a vertical axis, thus allowing the trucks to negotiate the sharpest curves with the least friction. This form of bogie was adopted after numerous experiments with other types having fewer wheels, none of which were satisfactory. It looks clumsy, but it works like a charm.

A simple catch secures the truck body in position on the bridle, and the end pins on which it swings are so placed that a loaded truck will turn turtle when the catch is released, and nearly right itself. This saves a lot of time at the ore bins, and prevents knocking trucks about.

Most of the truck bodies are U shaped, holding 12 cu. ft. of ore. They are strongly reinforced at the ends to stand the extra strain where the single pin is set on, and the bridles are made big enough to take a 15 cu. ft. pan when the present one wears out. Special bodies have been made to hold 15 cu. ft., U shaped for the drives, and V shaped for stopes, and have worked well. A 20 cu. ft. truck has been tried in the drives, but the rail in use was not stiff enough to carry this load without sag between the hangers. With a perfectly rigid road, and 14-in. wheels, I think a ton truck will be readily handled by one good strong boy. Such a load will, of course, be hard to start.

In the drives and wide stopes a U shaped truck body is preferable, but in narrow stopes a special V body, shaped to fit the floor of the stopes, is advantageous as it does away with the need of taking up the bottom.



MONO RAIL SWITCH AT JUNCTION OF ROADS.

In winzes only one bogie is used, with 6-in. wheels, and a special pan, or bucket, hung by the bridle from it. Winding is done by hand from short distances, and by air winch from greater depths.

The truck bridles should be made just long enough to allow for clearance of the loaded body when tipping. A long bridle tends to more swing on the curves in transit, putting unnecessary strain on the road and hangers. For the same reason the road should be carried as near the roof as is compatible with clearance and even grade, since the shorter the hanger, the less the lateral vibration. All roads

should, however, be erected with sufficient clearance for 14-in. wheels, if required. In the present 1 x 4 in. hangers, the flat side being towards the rail, full advantage is not taken of the strength of material. The hanger should be bent the other way so that the 4-in. face would stand at right angles to the rail, but such forgings are too expensive to make locally. In future it is intended to make the hangers in three sections, instead of two as at present, the foot and roof piece being so designed that the 1 x 4 in. vertical portion can be bolted up as suggested, giving the maximum rigidity. No turntables have yet been erected, but one has been designed for special work, and presents no difficulties whatever.

In comparing the efficiency of the mono rail in tramming, with the ground level system, for equal distances, it is difficult to arrive at exact figures. The best day's work with the mono was 120 trucks, of 12 cu. ft., trammed from an ore chute to the shaft bin, 130 ft. distant, by two boys working the ordinary shift. This would exceed 30 tons per boy, but the chute was always full, and the stuff ran freely into the truck without shoveling. Given a sound roof, and excepting abnormally wide stopes or lofty cross-cuts, it is my opinion that all underground tramming can be more efficiently done with a mono rail than with the ground level system.

In addition to the usual work of tramming from stope boxes and development faces, the mono rail, is particularly adapted for use in the stopes themselves.

Most engineers now believe in long backs for development. It is essential with such backs to have intermediate roads, say, two, between the development levels, along which the ore may be trammed to a central point from which to be sent to the tramming level below. The system which I propose where, as in the Langlaagte Deep, two reefs are worked, is to sink central ore chutes from the upper, or South Reef workings, to the Main Reef drive below, tram by mono rail in the upper stope to the central chute, and from the chute by mono rail along the drive to the shaft bins. For the lower or Main Reef, a cross-cut might be run back to tap one or more central chutes in each stope.

If an intermediate ground level road is put in a stope, the footwall must be blasted up; while with the mono rail, hangers are cheaply put up to cary any load; and even in a very narrow stope, by having the truck bodies made V shaped, the foot except in rare cases, need not be broken. If two or more intermediate roads are used, the saving in having the foot intact is considerable, and to this is added the advantage of having a clean road. No ore lodges on the mono rail across a stope, but with a ground level line the track will be covered as the ore is shoveled down and the traffic impeded much of the time. Where it is desired to use a gravity plane in connection with an intermediate stope road, this is easily arranged by placing overhead turntables at the junction of the roads.

In winzes, too, the mono rail is much better than the other system. Rails laid on the floor of a winze are frequently buried with stuff. The overhead rail is clean, reduces friction to a minimum, brings the bucket down to the bottom, and affords an admirable hand rail for climbing up and down.

An Air-Compressor Test.

BY JOHN HOWATT.

There is such a scarcity of material showing actual results of tests of air compressors in service that this brief summarization of a test made by the writer, and V. E. Goodwin, may be of interest. The test was made at the Chicago & Great Western Railway shops at Oelwein, Iowa. The compressor tested was of the well-known compound two-stage type, manufactured by the Ingersoll-Sergeant Drill Company, rated at 150 horse-power, when operating under 125 pounds steam pressure, compressing the air to 90 pounds. It operates all air tools and appliances such as are usually found in a well-equipped railroad shop. The sizes of the cylinders are as follows:

High-pressure steam cylinder, 14 inches diameter.

Low-pressure steam cylinder, 26 inches diameter.

Low-pressure air cylinder, 22¼ inches diameter.

High-pressure air cylinder, 14¼ inches diameter.

Length of stroke, 16 inches.

The speed of the compressor was governed automatically, so as to keep the air pressure in the receiver as near 90 pounds as possible.

In testing the compressor for efficiency, indicator cards of all cylinders were taken simultaneously at 15-minute intervals for a period of several hours. Below is given a table of the data obtained from these cards, which is of interest in that it shows how the load on an air compressor used for this class of work varies in short intervals of time.

The efficiency of an air compressor which has such a variable speed cannot, of course, be obtained by taking one or two sets of cards. Suppose a sudden drain were to come on the air receiver, lowering its pressure. The compressor immediately begins to speed up to supply the demand and keep the air pressure constant. While the speed is increasing the steam cylinders are supplying energy to the heavy flywheel, as well as to the air cylinders. This extra energy will not be shown on the cards taken on the air cylinders, but will be shown on the steam cards. Hence, the apparent efficiency obtained from the indicator cards taken at this time will be low. When the speed is decreasing the reverse is, of course, true.

AIR-COMPRESSOR TEST TABLE.

Steam, Total I. H.P.	Air, Total I. H. P.	Efficiency %.	R. P. M.	Gage Air Pressure.	Temp.	Cu. Ft. Free Air per Min.
48.6	36.6	75.4	44.5	91	156	304
45.6	34.3	75.3	42	90	159	287
75.4	54.5	72.5	65	89	167	444
91.9	65.0	70.8	77.5	87	174	524
68.8	49.0	71.3	58.5	92	180	400
86.2	61.3	71.3	73	88	182	498
98.4	69.6	70.9	83	88	186	567
84.4	61.0	72.4	73	90	184	498
70.9	52.3	73.9	63	90	185	431
89.1	65.5	73.5	80	80	190	547
101.6	74.5	73.4	100	70	175	684
107.0	72.0	67.3	96	70	168	656
126.8	87.0	68.7	104	87	180	711
92.4	65.0	70.5	77.5	91	192	524
91.1	64.5	70.8	77.5	90	195	524
58.7	44.5	76.0	54.5	86	192	372
52.2	37.0	71.0	46	94	185	314
AVERAGE.						
81.7	58.4	72.1	71.5	87	181	495

By taking the average efficiency as obtained from a good many sets of cards taken at regular intervals, the above difficulty was overcome and a result very closely approximating the correct value

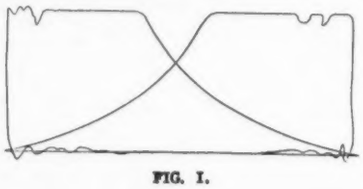


FIG. 1.

was obtained. The efficiencies given in the third column of the table are those obtained by comparison of the indicator cards directly, and the cubic feet of free air delivered per minute is given as air at the inlet temperature of 10 degrees Fahr.

The steam consumption per indicated horse-power hour was found to be 66 pounds. This is excessive and an inspection of a card of the high-pressure steam cylinder will show the cause. Fig. 3 shows such a card for a total load of 91.1 indicated horse-power. At this load the low-pressure card indicated only 19.9 horse-power, leaving 71.2 horse-power to be developed in the high-pressure cylinder. The average total indicated load of 81.7 horse-power was distributed with the high-pressure cylinder carrying 64.2 horse-power, the low-pressure cylinder carry-

FIG. 2.

ing only 17.5 horse-power. With a proper distribution of the load between the two

cylinders, the steam consumption could be reduced.

In Fig. 1 and Fig. 2 are shown typical cards of the high-pressure air cylinder. Fig. 1 is an average card, while Fig. 2 shows a card taken with the pressure in the receiver reduced to 70 pounds.

In making calculations on compressors it is usual to consider the final temperature of the air as 60 degrees. It will fall to whatever temperature the surrounding atmosphere is, anyway, and for unity that is taken at 60 degrees. This, of course, will give a lower efficiency than those given in the table. If the air could be used directly from the compressor while it still retained its high temperature, the efficiencies given would be the real efficiencies. There are two ways in which this correction can be made. The high- and low-pressure cards can be combined and an isothermal compression curve at 60 degrees can be plotted, beside the compression curve of the indicator cards. Such a curve applied to the high-pressure card is shown by the inner dotted line *A D* of Fig. 4. The area between this curve and the true compression curve represents the extra power which must be supplied and which reduces the ultimate efficiency.

Another method is to consider the mechanical equivalent of the heat units which

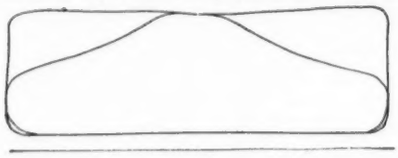


FIG. 3.

must be given up by the air in order to reduce its temperature to 60 degrees. In this instance, an average of 495 cubic feet of free air per minute were reduced, 181 — 60 = 121 degrees Fahr. The specific heat of air at constant volume being .1689, the B. t. u. given out per minute were

$$\frac{495 \times 121}{12.387} \times .1689 = 817, \text{ or } 19.2 \text{ horse-power.}$$

This reduces the average efficiency from 72.1 per cent. to 48 per cent. The cooling efficiency =

$$\frac{\text{Heat absorbed}}{\text{Heat of compression}} = 50 \text{ per cent.}$$

The efficiency of the cylinder jacket for cooling may be readily determined from the indicator cards. Thus, referring to

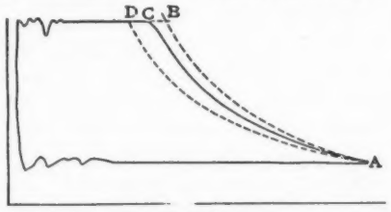


FIG. 4.

Fig. 4, *A B* represents the adiabatic compression curve. Hence the area *A B D* represents the total heat generated in the high-pressure cylinder, while the area *A B C* represents the heat abstracted by the jacket. Then,

$$\text{jacket-cooling efficiency} = \frac{\text{area } A\,B\,C}{\text{area } A\,B\,D}$$

During the test this averaged about 30 per cent., showing that the jacket was of considerable use in keeping the air cool. As the cooling water flowed at a constant rate through the jackets and intercooler, when the compressor was operating at high speeds the cooling efficiency was lower and the final temperature higher than for lower speeds.

Regulations for Silver and Copper Coinage in China.

In the past two years a large quantity of silver has been taken by China, chiefly through Japanese and Russian sources. This silver was used by the two nations chiefly for covering the commercial needs of their armies in Manchuria, and thus passed into Chinese hands. In addition to this, the heavy buying of copper in the United States and Europe, as well as from Japan, has aroused much interest in the new coinage of China. It will be of interest, therefore, to give the regulations affecting the new coinage by the Imperial Mint and the Provincial mints, which have been issued by the Imperial Government under sanction of the Emperor. These regulations are translated from the original Chinese, and are as follows:

1. In order to regulate matters relating to coinage, it is directed that the composition of the silver coins must be uniform. To secure this the different mints must make frequent tests of sample coins. The limit of variation allowed in the metal or alloy used is 1 per cent. If coins are found exceeding this limit, they must be remelted, and a penalty will be inflicted on the maker.

2. More difference is allowed in copper than in silver coins. The mints in the different provinces must be left in their present condition, and are not allowed to increase or add to their machinery, except those for which special permission has already been given. In future, no application for such permission will be allowed. The metal used in copper coins should be 95 per cent. copper and 5 per cent. zinc; 1 per cent. of tin will be allowed.

In all provincial or branch mints fineness should be the same as in the Imperial Mint. The treasury department will send sample ingots to the branch mints as standards for comparison. A special stamp is to be used for each provincial mint. The provincial mints shall send samples of copper to the treasury department to be tested; or the treasury department may send officers to the branch mints to make assays. In case the alloys differ from the standard, coinage shall be stopped and the coins issued recalled within a specified time.

3. As coins are for the convenience of the people, if too many 10-sen pieces or 20-sen pieces are issued, it will cause some trouble. The object of the treasury is to coin 5-sen and 2-sen pieces enough for circulation. The proportion should be in each 100 pieces coined, 10 of 20-sen, 50 of 10-sen, 20 of 5-sen, and 20 of 2-sen. Below 2-sen the old coins may be used.

4. The object of the coinage is to supply demand If the issue is too large, the value will be depreciated. In every provincial mint it is necessary to consult the state of the market. This should be done by some expert merchant, who is a money changer and is familiar with the market. If the coin is needed the mint should issue more; if there is too much, coins should be withdrawn from circulation. In issuing new coins also, it should be done in accordance with the amount of old coin in circulation. The adjustment of new coinage should be strict, to prevent frauds by dishonest merchants, or the exaction of unfair discounts. No mints will be allowed to push the issue of coin by lessening the price for its own profits. If there is any excess in the market, coinage should be stopped by order of the treasury department.

5. In any state new coin should be issued in those parts of the province where the supply of old coins is deficient. In any case a provincial mint should not send too much coin to any place at one time, so as to cause inconvenience to another province. In each province. new coin should be bought from the chief mint at a fixed price, if needed. In distant provinces the authorities can ask the mint of a neighboring province to make coin for them; but coin made in this way for another province is not allowed to be returned to the province where it was coined.

6. In each province the existing silver and copper mints must report to the treasury department, through the viceroy, what machines are in use; the number; where bought and the cost; and from what country the machinery has been imported. The report should also describe the buildings and give the number of men employed and the working hours. This should be done once in three months. Also an annual report must be made of how much silver and copper coin is made; the quantity of metals used; the cost; and the profit made in coinage.

7 Hereafter in the chief mint new silver coin should be made from the old silver coins, or taels. If the mint receives these coins from the treasury department the cost of transportation will be large; therefore, in future, when tribute is received from local governments by the treasury department, the tael money should be examined, and all coins of proper composition sent to the mint

at Tien-Tsin. The officer in charge there will be responsible for receiving the money, and will report on the same day to the treasury department. The responsibility of the officer in charge ot the tribute will then be ended.

8. As in any country the right of coinage belongs to the government, there is no reason for according it to individuals. By this time when no more branch mints will be allowed, no private mints are to be operated by individuals or companies, even if merchants are anxious to secure profits of coinage. The treasury department will send inspectors to different mints and when it is found that some private capital is used, the government officers will withdraw them, and will stop all coinage, in order to protect the rights of the government.

9. Coin made by the Imperial Mint, or chief mint of the treasury department, may be sent throughout the Empire. The coins will be deposited in the Central Bank, when that is opened. In these provinces where coinage is deficient, coins from the chief mint will be sent out, on proper requisition.

10. In the copper mints of the provinces the dies, in the beginning, were not properly made, and were not provided in sufficient number. At that time new dies were obtained from Japan. As the dies from foreign countries are sold at a low price, although labor and material are more costly, the composition must be inferior. Moreover, unfair merchants might purchase foreign dies in large quantities, and make coins secretly. But now that the composition of the coin has been brought to a uniform standard, by the opening of the pronvincial mints, and time has been given to make the coinage in the country, there is no reason why the die should not be made in China by working from the original metals. Therefore the importation of these foreign dies is prohibited. The provincial viceroys will make this public, and the department of foreign affairs will give the necessary orders to the customs. This law will be strictly enorced.

The above rules are to be adopted at once, and the treasury department will proceed to examine the copper coins made by the different provincial governments. The department will also see that a proper quantity of coins is provided, and issued in accordance with the demands in order to maintain the standard and not to cause fluctuations in silver values.

Prospecting for Lead and Zinc.

BY R. M. DOWNIE.

The first requisite in scientific prospecting is that the drill have a long, quick stroke. It should make about 60 strokes per min., with each stroke 30 to 40 in. long. To gain this speed it is necessary to raise the drill in about one-half the time it requires in falling. This rapid up-stroke is just as important as the rapid down-stroke. Such a drill, if of good weight, will cut up the rock and minerals into coarse chips; and the long, rapid up-stroke will then keep the cuttings afloat, thus preventing their settling on the bottom, to be recut and powdered by successive blows of the drill. The rapid upward motion of the drill-bit creates a sort of suction or wash, at the bottom of the hole, which lifts the chips and keeps them afloat until the well is ready for "sludging."

It is well known that lead or zinc ore can be so finely pulverized that a tablespoonful of it can be mixed in a bucket of clear water without being visible to the naked eye. When thus pulverized, the particles are so impalable that it may require a half hour for them to settle to the bottom of the vessel. It follows that, if such pulverizing be done by the drill, the chances are that much of the mineral will be carried away in the muddy water pumped from the bore hole. It therefore follows that, if mineral is suspected, *all* the "sludge" should be saved and allowed plenty of time to settle; but the main thing is to prevent the pulverizing. and this is done, by the long, swift stroke of the drill.

A second requisite for accurate and reliable prospecting is a means of thoroughly cleaning up the borehole after each run of the drill. The common bucket will not do this. When the drill is withdrawn preparatory to sludging, a settling immediately takes place; and the minerals, being heavier than the rock cuttings, will, of course, settle on the bottom of the bore-hole. The common sludge bucket operates by gravity only, and brings up only such of the cuttings as flow up into it through its valve; it thus inevitably leaves more or less of the cuttings on the bottom of the well. This unrecovered residum will always be the mineral, if mineral there be among the cuttings; and, if left in the bore-hole, it will be mixed with the cuttings from the next run and may deceive the prospector into the idea that the mineral-bearing ledge is much thicker than it really is. While this is an extremely important matter it is very easily overtaken and provided for.

The proper thing to use for completely cleaning the bore-hole is a sludge pump that will gather up everything and bring it to the surface. It should be so constructed that if a handful of bird-shot be thrown into the bore-hole, it will recover every grain of it. A sludge pump which will not do this should not be used. Pumps of this kind are easily and cheaply obtainable and should always be used when the mineralized stratum is reached. With proper machinery it should cost no more to make the tests with sceintific accuracy and reliability than to make them the other way.

White Labor in the Tropics.

In an interview with an Australian correspondent in Sydney, recently, Harold Conroy, who has resided for many years in the tropical districts in Central and Northern Australia, stated that his experience in Central Australia, in the northwest portion of New South Wales, and in the western, northern and north coast districts of Queensland, during the 1896 drought and heat wave, convinced him that not only can the white man beat the colored man when it comes to working in a tropical climate, but the harder the white man works, the better the health he enjoys. With the thermometer sometimes standing 130 deg. in the shade, he saw white men tanksinking, opal-digging, woodcutting, water-hauling, roadmaking, and mining, and it would be hard to find a more healthy or finer stamp of men. Most of them had ample opportunities to seek a cooler climate; but although indigenous birds and animals were dying in thousands from the effects of the heat, these men seemed perfectly contented, and never neglected their work. Certainly in a few far western towns some people succumbed from the effects of the heat, but these were of the corpulent class, chiefly aged storekeepers.

Again there is a noticeable absence of consumption and other wasting diseases in these districts. Of course, tropical climates have their disadvantages; but in the tropics the heat is generally uniform, and one does not experience the whole four seasons of the year in one week.

Once he had occasion to stop at a small town called Thargomindah, Queensland, which place had an unenviable reputation for climate, and although its population consisted of only about 300 people, and the nearest railroad communication was almost 150 miles away, under a system of local government the town was brought quite up to date. Electric lights illuminated the well laid-out streets, water was laid to every residence from an artesian bore, while a divisional board hall had been built that would humble the city hall of larger towns, thus showing that the inhabitants were both energetic and contented. Taking things right through, the white working classes in the tropics are better off in both health and pocket than those in cold climates, and although at times they may be hard pressed by drought, they have a better average rainfall than many of the cooler climates. The Gold mines in Western Australia which are in the hot zone, have all been discovered, and are worked by white labor, and all admit that they are successful. Speaking from practical experience, he is thoroughly convinced that not only can white men stand the tropical climate as well as the colored man, but when it comes to hard labor the white man is superior to the colored man.

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THE PAPER BY Mr. Fohs, on faults and fractures, printed in this issue, is an interesting contribution to the physics of the earth's crust. Readers who are interested in the subject will naturally refer back to the allied papers in this JOURNAL, especially the one on "Simultaneous Joints," by G. F. Becker, in the issue of June 22, 1905, p. 1186. The subject is both interesting and important.

The Debris Question in California.

The field work of the State Anti-Debris Association is now under the charge of a committee composed of one supervisor from each four valley counties, who have full control of the watchmen, and it is intended from this time forward to inspect the hydraulic-mining territory thoroughly and to prepare a map book showing the location and condition of every mine so as to prohibit injurious hydraulic mining. This is really the business of the California Debris Commission, a Federal body authorized to enforce the laws about hydraulic mining in certain portions of this State. But the Anti-Debris Association, a self-constituted organization, without official standing, continues to harass the hydraulic miners by bringing injunction suits, even after permits to mine have been granted by the authorized commission.

Mining Rights in Sonora.

The Mexican Government, by order of President Diaz, has rescinded the order prohibiting foreigners from acquiring property in Sonora and Baja California, which was issued recently and was noted by us at the time. This further action has naturally created great satisfaction among the Americans who are operating, or have interests, in those portions of Mexico. The early cancellation of the order was not unexpected, however, the purpose of the order having been obviously to impress the foreigners in Mexico with the necessity for fair dealing, and the existence of certain rights and powers on the part of the Mexican Government. The Mexican Government itself is highly interested in the exploitation of the mineral resources of the nation, but it naturally rebuked the malicious aspersions which had been cast upon it by certain foreigners, and took the course which has now become simply a matter of history.

The Bessemer Memorial Fund.

The purpose of this fund is to aid in the endowment of the metallurgical and mining department of the newly organized and enlarged Royal School of Mines. The generous subscription of Messrs. Wernher, Beit & Company (£100,000) will help in the providing of buildings; but new equipment is needed for modern laboratories and a testing plant, for instruction and research. Appeal is made for this fund, on the broad basis of international scholarship for practical graduate-work. The cause should enlist the sympathy and support, both of those interested in the distinctively English side of this plan of educational work, and also of those who would aid the exchange of international educational facilities for the mining profession. In the United States, Prof. H. M. Howe is sponsor for this proposal, which incidentally commemorates the achievements of the late Sir Henry Bessemer. The secretary is C. McDermid, Esq., Salisbury House, London, E. C.

Lead Smelting in British Columbia.

The recent reduction by the smelters of British Columbia in the rate for the treatment of silver-lead ore will be of a good deal of benefit to the mines of the Slocan district and the southeast Kootenay. These mines produce chiefly a galena concentrate, assaying 50 per cent. and upward in lead. Heretofore this ore has been smelted at a combined freight and treatment rate of $15 per 2000 lb., 90 per cent. of the lead being paid for at the London quotation for soft Spanish, less 1c. per lb. to cover freight, refining and marketing charges. The rate has now been reduced to $12 per 2000 pounds.

This reduction appears to have been due not so much to benefit the miners as to meet the competition of European smelters. For a long while there has been in Europe a scarcity of high-grade galena ore, such as is produced in British Columbia, and European smelters have been offering liberal terms for that class of ore. It was, however, difficult for them to do business in British Columbia so long as the Dominion bounty applied only to lead smelted in the Province. The smallness of the output of many of the mines, and

their inability to enter into contracts for regular delivery, also were deterrent to an export business. A couple of years ago, however, the St. Eugene, which is the largest producer of lead in the Province, secured the application of the bounty to ore that might be exported by it under certain conditions, and entered into a contract under which a considerable tonnage of ore was shipped to Europe.

The gradually rising price of lead in 1905 finally carried the metal on the London market to the point where the Dominion bounty ceased and put the European smelters on equal terms with the Provincial, in so far as that matter is concerned. Some inquiries for ore for export were made in the local market, which doubtless were of more or less effect in bringing about the recent reduction on the part of the local smelters.

The Geological Survey.

The Hon. Chas. D. Walcott, director of the Geological Survey, has recommended to Congress that a new building be erected, at an estimated cost of $1,200,000, for the occupancy of the Survey. In making this recommendation Mr. Walcott remarks that the property and records in the rented building now occupied by the Survey amount in value to about $6,000,000 and are in constant danger of loss by fire.

We heartily approve this recommendation. Indeed, we consider the provision of a suitable building for the Survey a matter of urgent necessity. It is little short of a disgrace that an organization of the magnitude and practical importance of the United States Geological Survey should have for its headquarters only the mean, second-rate building which it now occupies. The niggardly provision for so important an organization is highly unprepossessing to the visitor in Washington and cannot fail to create among foreigners an impression of which we ought to feel ashamed.

The danger of fire, which Mr. Walcott points out, is no cry of "wolf." The building would be condemned by any fire underwriter as a dangerous risk. We believe it has, indeed, been once on fire, but was saved by prompt action and good luck. It is an ordinary building of old-fashioned construction, which is divided into a large number of small rooms by inflammable partitions, and is crowded with desks, tables, shelving and other inflammable material. This miserable building contains a library of upward of 70,000 volumes, which is one of the largest technical libraries in the United States, the extremely well equipped chemical and physical laboratories of the Survey, and a large quantity of valuable maps, records, etc., which could never be replaced.

The Geological Survey has done immensely important work for the mining industry of the United States, and is increasing every year in usefulness and general appreciation. It surely should be provided with headquarters which would not only be safe, but also would be a credit to itself and to the great industry which it represents.

Steel Production in the United States.

Steel production in the United States in 1905 showed an advance even greater than that in the pig-iron output. The increase in bessemer steel was large, but it was surpassed by that in open-hearth metal, which reached a total last year not only far beyond that of any preceding year, but also much in excess of anticipations and earlier estimates. The American Iron and Steel Association has now completed its statistics of open-hearth steel for the year, and there remains to be ascertained only the comparatively small quantity of crucible and special steels. Estimating this for the year, we have the following statement of production for the last two years:

Class.	1904. Tons.	1904. Per Ct.	1905. Tons	1905. Per Ct.
Bessemer	7,859,140	56.6	10,941,375	54.6
Open-hearth	5,908,166	42.7	8,971,376	44.8
Crucible, etc	92,581	0.7	121,000	0.6
Total	13,859,887	100.0	20,033,751	100.0

While the gain in bessemer steel last year was 3,082,235 tons, or 39.2 per cent., that in open-hearth metal was no less than 3,063,210 tons, or 51.8 per cent.; while the total increase was 6,173,864 tons, or 44.5 per cent. This great advance makes the ratio of steel to pig-iron production the highest shown by any important producing country; it was 87.1 in 1905, against 84.1 in the preceding year.

The most noteworthy point about this statement is the rapid advance of the open-hearth process. Last year nearly 45 per cent. of the steel output was from the open-hearth furnace; and if the recent rate of progress continues, it will take only a few years for converter steel to fall into the second place, as it did in Great Britain several years ago. It is noticeable, too, that while the open-hearth process is more readily adapted to the needs of smaller works, a great part of the gain has been in the larger plants, most of which have increased the number of open-hearth furnaces, while that of bessemer converters shows only a moderate gain.

The proportions of open-hearth steel made by the acid and basic processes for three years past have been as follows:

Year.	Acid. Tons.	Acid. Per Ct.	Basic. Tons.	Basic. Per Ct.
1903	1,094 998	18.8	4,734,913	81.2
1904	801,799	13.6	5,106,367	86.4
1905	1,155,648	12.9	7,815,728	87.1

The increase in the proportion of basic steel, though less marked in 1905 than in the previous year, was still considerable. As all the converter steel was made by the acid process, basic metal formed last year 39 per cent. of the total steel output, against 36.8 per cent. in 1904. The basic converter has never been used to any extent in this country; and the two small plants—at Troy, N. Y., and Pottsville, Penn.—built to use that process have not been in operation for several years past.

The make of over 20,000,000 tons of steel in one year is an achievement wholly without precedent. It shows the point to which the productive capacity of the United States has been brought; it may be added, the consuming capacity also, for all of this steel was required to meet the demand for finished forms during the year.

The Defeat of Unionism at Bisbee.

For many years the Western Federation of Labor has cast an envious eye on the payrolls of the mines of Bisbee, Arizona. These payrolls have grown continuously with the development of the mines of the Copper Queen, Calumet & Arizona and other companies, and are now very large. Nearly 4000 men are employed in mines of this important copper camp, and contributions from this number of well paid men would quickly give the Western Federation a renewed lease of life, and a strength it has lost.

There has never been any suggestion that the miners at Bisbee were ill treated. On the contrary, it is admitted that they have been remarkably well treated. The Butte scale of wages and Butte hours prevail at Bisbee; and the companies have been careful of the welfare and comfort of their men, both underground and when unemployed. In particular, the Copper Queen Company has been uncommonly altruistic in its methods; and its

large and splendidly equipped hospital, its fine gymnasium building (now turned over to the Y. M. C. A. for operation), its reading rooms and library, and its natatorium, furnish outward evidence of a desire expressed in many ways and always prominent.

Among the miners employed at Bisbee, it is probable that a large proportion are now, or have been, union men. They come largely from California, Colorado and Montana. If the Western Federation suited them, they would surely want it established in practically the only large western camp where it has no foothold. Indeed they would be expected to aid its organizers.

Of the numerous attempts made from time to time to engraft unionism upon Bisbee, the most ambitious has just come to a close. For three months organizers have been there, working individually and jointly. They have importuned the miners, have held meetings and addressed many street gatherings. Every method known to the Western Federation, and available in the present instance, has been tried to convert the camp to unionism. Finally a vote was taken, and in this referendum about 2700 miners took part. The majority in favor of maintaining the open camp was surprising. Only 15 per cent. of the men voting wanted unionism. The rest thought they were doing well enough as they were.

Such a conclusion to this important contest—important not alone for its bearing on the future of a young and growing camp, but still more so in its effect on the Federation, which is just now in especial need of support—must be gratifying to the managements of the Copper Queen and Calumet & Arizona companies, as it is a high compliment to their methods in the Bisbee camp. It is furthermore gratifying to see that the men, in this instance, appreciate a good thing when they have it. There are many mining corporations which might profit from the experience of the Copper Queen and Calumet & Arizona at Bisbee, and model the treatment of their employees on the same line of generosity and consideration.

The Handling of Ore Underground.

The paper by Mr. Bradford, which is published in this issue, is both practically instructive and suggestive. The handling of ore underground, from the stopes to the hoisting shaft, is one of the most expensive items of mining cost. In the ordinary practice of mining in the Rocky Mountains, in mines producing a large tonnage of ore, where the total mining cost is about $2 per ton, the cost of shoveling up the ore in the stopes, and tramming it to the shaft is apt to be in the neighborhood of 40c. per ton, or 20 per cent. of the total cost of mining. In some mines, of short levels, the cost may be considerably less than that figure, but on the other hand mines of such development that a long tram is necessary may show, and do show, a considerably higher cost for this item. The cost is, moreover, materially affected by the conditions of the ore deposit. In some mines, it is necessary to shovel up all the ore; in others it can be handled by gravity to a more or less extent.

The very magnitude of this item of cost leads the engineer and mine superintendent to the consideration of means for its reduction. In surface work, transportation is done in most modern plants by mechanical means, viz., electric tramways, cable railways, mechanical conveyors, etc. In coal mines, haulage systems have been highly developed; but in metal mining the reverse is the case, although some large mines, like the copper mines of Lake Superior, have installed electric haulage systems. In the average mine, of moderate size, however, such an installation would be of little or no advantage. The introduction of belt conveyors, and similar means of transportation, has been suggested and considered, but most of these are limited to straight lines, and the galleries of a mine are apt to be anything but straight. Moreover, underground conditions are likely to be unfavorable in other respects to the operation of machinery of many working parts.

The installation which is described by Mr. Bradford outlines a new system, which would appear to have considerable application, and anyway may profitably be studied. In this connection, it is worthy to note the great attention which is being devoted to matters of this kind by the engineers who are operating in South Africa. They are confronted by difficult conditions, not merely in the narrowness of their vein, but also in the gentle slope of the vein (which in the deeper levels is usually less than the angle on which ore will slide), the great lateral development, and the great depth to which the mines are being worked; furthermore, the labor difficulty is always a pressing one. Under the stress of these conditions the operators are forced to consider possible improvements, which elsewhere may be disregarded because of the lack of actual necessity. The old saying that "necessity is the mother of invention" is finding great application in South Africa, and in many respects the engineers of that country, who will cheerfully admit their original debt to America, are now leading the way in mining practice.

The recognition of this general opinion was recently very nicely expressed by A. G. Charleton, a former president of the Institution of Mining and Metallurgy, and himself unconnected with any of the South African mining interests. In connection with the current discussion as to the labor question in the Transvaal, H. W. Massingham had remarked that the necessity for Chinese arose chiefly through the discouragement both of white and of black labor; that black labor is wastefully used in the mines; that higher wages and better treatment would ensure a larger, if not an absolutely sufficient supply; and that the balance could be made up by a freer resort to machinery and white labor, and a scientific reorganization of mining work.

Mr. Charleton replied that the engineers and managers on the Rand will compare favorably with any body of men in the world as regards ability, enterprise, and practical training. They are fully alive to the necessity of economizing labor, and reducing working costs to a minimum, which is absolutely essential in order to make profitable such low-grade undertakings as the mines of the Transvaal. The keynote of progress in South Africa lies in the employment of mechanical devices, but these can be overdone, and their employment may cost more than the use of unskilled labor. The narrow reefs of the Rand, with their relatively flat dips, necessitate much more handling underground than is usual in other gold mines, but rock drills and every known type of modern machinery are employed as liberally on the Rand as in any part of the world, and devices are in use to save labor, which are elsewhere unknown, such, for example, as the "shaking chutes," which are used in the stopes.

Metallics.

Modern gas power plants will produce a brake horse power on approximately one pound of coal, including all auxiliaries.

Small steam engines use from three to five times the amount of coal per horse power that is required by those of larger capacity, but the small gas engine is practically as efficient as the large one.

Don't carry powder about the person to soften it, or attempt to thaw it in the flame of a candle, nor crimp a cap with the teeth nor "break" a stick in two. Cut it, no matter how dull the knife is.

A mixture consisting of 50 per cent. aluminum, 25 per cent. zinc and 25 per cent. tin forms an alloy which is excellent as a bearing metal. It is light in weight, has a fair degree of hardness and a moderately high melting point.

The two-cycle internal combustion engine gets an impulse at every revolution of the flywheel; the four-cycle engine gets one only at every second revolution. Strictly speaking, the engines are two-stroke cycle and four-stroke cycle machines; that is, the cycle of events in the cylinder is repeated every two or four strokes as the case may be.

Torque in the direct current electric motor is dependent upon and proportional to field strength and armature ampere-turns. Each of these varies directly with the current; hence for a given increase of current, the corresponding increase of torque is much greater. In a motor whose magnetic circuit has not become saturated, the torque is proportional to the square of the current.

There is a diversity of opinion with regard to covering up flanges; the chief objection raised by some engineers is that when covered they are unable to see blowing joints. With several designs of flange covers this objection is easily overcome. The bare flange of a 6-in. diameter pipe gives about 2 sq.ft. of exposed surface and would roughly show a saving of from $2.50 to $3 per annum if covered.

It is unwise to start to drill in a new face until it has been proved that there are no missed holes or unexploded pieces of powder left in the old butts or cut-off holes. If such are found, re-prime and shoot them before starting in to drill, as a slip may connect with the charge that will transmit a sympathetic concussion from the drill, especially if a machine is being employed.

Francis Fox states that the length of the Simplon tunnel, which is 12½ miles, is greater than was planned by 31 in. The levels of the two galleries were within 3½ in. of one another. The axis of the tunnel, driven from the north end, deviated 4⅓ in. toward the west, while the line driven from the south end deviated 3⅓ in. toward the east; the greatest divergence from the true line, 3⅓ in. is well within the probable error.

Powder accidents caused five fatalities in Idaho in 1905 and also three serious non-fatal accidents from striking loose pieces of powder in muck piles with picks. This is an ever-present danger in heavy blasting operations, as holes frequently cut off live portions of a charge which are scattered among the muck. There is little danger of exploding these stray pieces if the pick is used properly and not jabbed into the muck with unnecessary force.

The best test when using alkaline compounds for water softening is to run some of the water from the boiler into an ordinary tumbler and add to it a few drops of phenolphthalein, which reagent is milky white in the presence of acids and bright crimson red in the presence of alkalies. Supposing the color changes immediately to a bright red, the supply of the boiler compound should be cut down, until on repeated repetition of this experiment the color produced is a pale pink, showing only a trace of alkalies present.

Any system of water softening for boiler feed purposes is in principle, the substitution of a less harmful substance to take the place of a more harmful substance which is eliminated in the process. Therefore, the exact amount of the boiler compound, no matter what it is, should be added to the boiler feed water in such manner that there is no appreciable excess of the boiler compound; too much of this would have bad effects in the boiler. It is, therefore, necessary that the user of water for making steam in his boiler shall know what his feed water contains, and keep a check on the amount of the boiler compound he adds to the water.

Neat cement or rich or dry mortars are more liable to crazing or hair cracks than mortars containing a larger proportion of sand or finely crushed stone, or than those mortars laid very wet, or kept wet for a long period. This is particularly true in the manufacture of cement blocks in which the mixture is poured very wet. When the block is seasoned by keeping the surface covered with a thick layer of wet sand, or when the stone is immersed entirely and for some time in water, the trouble is almost overcome. These hair cracks would be entirely eliminated if the stone were immersed in water for a sufficient period to allow the complete crystallization of the cement.

In a stope 36 in. wide in the Village Deep mine, Transvaal, four small "Giant" drills were tried. The ground was hard and the results unsatisfactory. The men seldom were able to get their four 5-ft. holes per machine in and blast. One fault was the machines were too weak for their work and were under constant repair, the ratchets especially and feed screws not being equal to the stress of the blow on the hard rock from an air pressure of 75 to 80 lb. Small steel was used, viz., 1-in. starter, and 2-in. to 2¼-in. face, and there were plenty of drills, both star and chisel. The small machines were replaced by 3-in. Ingersolls, and excellent results by the same men were obtained.

Electric haulage has been introduced in several of the mines of the Cœur d'Alene, and proves an ideal power for handling the heavy tonnage of ore through the extensive underground levels and tunnels, small motors using a direct current of 500 volts being employed in this work. This voltage is supposed to be harmless, but results prove otherwise, as these live wires were the cause of two fatal accidents in 1905, evidently due to the peculiar physical condition of the victims or manner of contact. In such low avenues as mining tunnels through heavy ground involve, it is impossible always to carry the trolley wires very high above the track and they must be religiously respected, and protected as much as possible by guard rails at the most exposed points.

It is common to judge the efficiency of non-conducting materials by the outside temperature; that, however, is misleading. The measuring of condensed water is the most reliable test. A certain steam main, which in 20 hours condensed 2327 lb. of water before being covered, after being covered condensed only 613 lb. Stated roughly, non-conducting coverings diminish heat loss by 75 to 90 per cent. A saving of $1.25 to $1.50 per sq.ft. per annum may be effected, and coverings may be paid for four times over in a year by coal saved. A non-conducting covering costing 4c. a year in interest and 4c. for sinking fund, to last five years must save 8c. to be worth applying. But if a life of 10 years is probable, the extra five years at 4c., after paying the sinking fund, would give a certain profit of 20c.

Tests made in hand firing at the works of Davy Bros., Sheffield, Eng., illustrate the personal element introduced in good and bad firing. Five men were made to fire the same boiler with the same coal and with the steam pressure, as nearly as possible, the same. The best was able to obtain an evaporation of 9 lb. of water per lb. of coal, the worst evaporation being 7.4 lb. per lb. of coal; a difference of 22 per cent. The opportunities afforded for increasing the efficiency of the boilers were, in this instance, limited; a well laid fire, which by constant attention is prevented from burning into holes, is one of the chief items in securing a high evaporation. Keeping the grate-bars clean, and proper damper regulation, contribute greatly to high efficiency. Beyond these points there is little opportunity for exercising skill, and yet there tests show clearly how very important the simple operations in firing a boiler become. The very simplicity is the one cause for neglect.

Colliery Notes.

Motor haulage is preferable to rope haulage on level roads, and where there are numerous windings and irregularities in the seam, causing short variable grades and sharp curves.

In collieries employing underground electric haulage the broken coal is loaded into cars and pushed by hand to the room necks. Locomotives go into the side-heading, reaching in with a chain when necessary, and collect the first half dozen loaded cars. These are then used as a chain when backing up the heading many times to collect a full load. There is much more power used and wear and tear caused in these operations than there is on the main haul with a full load.

In general, the exhaust system of ventilation is preferable in the working of a gassy mine, because the intake airway can then be used as a haulage road without necessitating the use of doors on this road at the shaft bottom. In a non-gassy mine the blowing system is generally to be preferred, because in the use of this system, the mine being ventilated under a pressure above that of the atmosphere, the gases generated in the mine tend to escape from the mine by every opening or crevice.

The chances of an explosion in a coal mine by natural causes are small. Such an explosion would depend upon the simultaneous occurrence of a mixture of fire-damp and air in explosive proportions, and of peculiar natural circumstances capable of raising the temperature of the mixture to the ignition point. It is chiefly in very deep collieries where such conditions may be expected. In deep workings heat is developed by the strata being crushed and ground under excessive roof strain. Excessive oxidation of pyrites is also an important factor.

The only conditions under which it is advisable to adopt the single-entry system throughout, occur in the working of a small drift mine under a good roof, and where it is not intended to extend the workings to a great distance from the mine opening. There are certain conditions in the working of inclined seams, when the mine is dry and the seam has a good roof and floor, under which it is profitable to drive a single entry to the right and left of the main slope, such entries or gangways to be driven only, say, 1200 to 1500 ft., leaving the coal lying beyond this to be reached by gangways from another slope.

Coal possesses a comparatively high electrical resistance. The following values in megohmns (a megohm equals 1,000,000 ohms) per cubic centimeter indicate the magnitudes of the specific resistance of coal and other well-known bodies; guttapercha 400,000,000, arc-light carbon, 0.000,000,004; and coal 40,000. It will thus be seen that coal possesses ten million million times greater electrical resistance than arc-light carbon, and ten thousand times less resistance than guttapercha of the same dimensions. It has likewise been experimentally shown that coal has from 3000 to 4000 times greater electrical resistance than limestone and similar rocks.

There are two general methods of ventilating a mine, namely, the blowing or plenum system, and the exhaust system of ventilation. In the blowing system the mine is always ventilated under a pressure greater than that of the atmosphere. This pressure may be caused by a fan, water-fall, wind cowl, or other mechanical device. In the exhaust system the mine is ventilated under a pressure less than that of the atmosphere. The mine pressure is decreased below that of the atmosphere, either by natural means, as in natural ventilation when an air column is formed in the upcast shaft due to the natural heat of the mine, or by some mechanical means such as an exhaust fan or steam jet.

Recent colliery explosions have shown that the fine coal dust that settles on the timber and sides of roadways is an element of serious danger. This danger can be considerably reduced by carefully drying the ventilating currents; as the drier the air in a colliery is kept, the less liability there is for an explosion. Experiments have shown that until the dampness in the air exceeds 25 per cent. of the weight of the air it will have no retarding influence on the extension of the flame in an explosion. There is less liability to an explosion in a mine where precautions are taken to remove as much of the dust as possible, and where the ventilating currents are dried, than in a mine where the dust is allowed to accumulate and the air is moist.

The method of drawing pillars best adapted to any case will depend wholly on the conditions with respect to the character of the roof, floor and coal, the thickness of the pillars and the inclination of the seam. It will be always necessary to adopt such methods as will provide a safe retreat for the workmen. In flat seams with a roof that is not too hard nor too soft and having a good floor, it will only be necessary to keep the work of drawing back the pillars in a straight line so as to avoid an excessive roof pressure on any of the pillars by reason of the work being delayed. All standing timber should be drawn as the work progresses and a fall of roof induced. In inclined seams, a narrow man-way may be driven up the center of a wide pillar, and cross-headings driven to divide the pillar in small blocks, a single shot being placed in each block of coal.

Correspondence and Discussion.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested.

Readers are invited to use this department for the discussion of questions arising in technical practice or suggested by articles appearing in the columns of this JOURNAL.

Letters shoud be addressed to the Editor.

We do not hold ourselves responsible for the opinions expressed by correspondents.

Smelting Zinc Retort Residues.

Sir—In my article, "Smelting Zinc Retort Residues", appearing in the JOURNAL of Feb. 17, p. 318, occurs a mistake in punctuation, which I neglected to correct in the original in *Western Chemist and Metallurgist.* Commencing with the 17th line, it was intended to read as follows:

"This loss of lead, however, was not entirely due to the low furnace, as no provision had been made to separate the slag and matte. Upon assuming charge," etc.

E. M. JOHNSON.

Iola, Kansas, Feb. 22, 1906.

Analysis of Cyanide Solutions.

Sir—On page 43 of the last special annual statistical number of the JOURNAL, (Jan. 6, 1906) in his paper, "Progress in Gold Ore Treatment during 1905," Mr. Alfred James says that Mr. Pawle, of Borneo, assays his solutions by throwing in a handful of zinc and adding hydrochloric acid, and lead acetate. The lead precipitate is rubbed into a pill in the palm of the hand, and cupelled, etc. He speaks of it as if it were quite a new process. Perhaps, in this matter, some injustice has been done both to Mr. James and to myself; as the process was first suggested to me by Mr. James' book, and I pushed it on a step.

ALFRED CHIDDEY.

Encuentros Mines,
Salvador, C. A., Feb. 15, 1906.

Concentration of Silicious Copper Ore.

Sir—I must say that I heartily agree with you in the remarks in your issue of Feb. 24, regarding special processes for low-grade copper ores. Undoubtedly some of them are excellent from a technical standpoint, but the margin between a grade which will just pay on the one hand, and a grade which is just too heavily mineralized on the other, is probably not so large as is generally supposed. It is within this margin that any process employing oil as the concentrating medium must be applied, and in any event it would be unwise to limit deliberately the scope of water concentration in order to provide a suitable feed for more complicated processes. In the case of mines situated close to smelters, it is only natural that the scope of all concentration processes should be much more limited than in districts not possessing these advantages.

New York, March 1, 1906. L. R. L.

The Baggaley Pyritic-Conversioon Process.

The Baggaley process, which is now in operation at Butte, Mont., and has been frequently referred to during the last two or three years, but not heretofore described, is designed to effect the concentration of any kind of copper, gold or silver ore. It aims also to render possible the treatment on a commercial basis of low-grade, pyritic copper ore by smelting only (avoiding water-concentration, with its high losses of mineral), and producing originally a low grade of matte; to enrich the latter, by stages, up to blister copper in a basic-lined converter, the silica required to flux the iron of the matte being introduced into the converter in the form of silicious ore.

The following description of the process has been communicated by Mr. Baggaley, to whose courtesy we are also indebted for the report to him by William A. Heywood, manager and metallurgist of the Pittsmont smelter, of the smelting operations from Aug. 18, 1905, to Feb. 1, 1906, which is published herewith.

The first smelting, which is intended solely to remove the gangue with minimum mineral loss, may be done in the ordinary blast furnace, by the pyritic or semipyritic' process, as is described in Mr. Heywood's report, but no attempt is made to produce a matte of high grade. The first fusion may also be accomplished by ordinary reduction smelting in a blast furnace with no attempt at concentration beyond what results from a simple fusion of the ore. With Butte ores this demands from 7 to 10 per cent. of coke. Or it may be done in a special converter, provided with a forehearth, which is the preferred method. In this, a bath of clean matte is used with which to start the process. It may be derived from a cheap cupola or any other available source. It is made preferably from a simple smelting (without any attempt at concentration), of ores rich in sulphur and iron. The iron supply of the bath is thereafter continued indefinitely by feeding continuous charges of raw ores of this character. The character of the bath may be regulated by the kind of ores fed.

The primary converter is designed to supersede the ordinary blast furnace, and its ore charges are intended to correspond; the difference being that it does not require coke and non-mineral bearing fluxes, and it does not create a reducing action during fusion.

The converter is preferably 20 ft. in length by 8 ft. in diameter; it is provided with say thirty-six 1¼-in. tuyeres.

After the converter has been charged with its bath of matte, blast is turned on in great volume and the ore-feed is commenced. The latter may be continuous or intermittent.

Before entering the converter, however, the ores are preferably passed through some form of preheater, wherein the heat of the waste gases can be utilized. This materially augments the smelting capacity of the converter, although it is not necessary to the success of the process. Excellent results are obtained from feeding wet ore.

The ore enters at one end and floats slowly toward the opposite end of the converter, being subjected to the corrosive action of the low-grade basic matte and the intense heat produced by the enormous air-blast acting upon the bath.

Being dropped instantly into the smelting temperature (in excess of 1300 deg. C.) which always exists in the bath, the sulphides contained in the ore are melted immediately and join the matte, thus becoming available as heat producers in continuing the smelting process. A great excess of silicious ore may be fed in, beyond the proportion that can be fused and which can form selective slags with the iron oxidized in the bath. The mineral contained in these is liquated out and joins the bath of matte. The clean silica shells float away and pass off with the slag. The separation is exceptionally clean.

The primary converter, at the end opposite to the feed, is provided with a water-jacketed, untrapped, overflow spout in its axis. As the smelting progresses, matte, slag and unfused silica ore-shells constantly overflow, the same as from a common blast furnace. These drop into a forehearth, preferably 20 ft. in length and 10 ft. in width, where separation occurs. The matte is not desired to exceed the grade of 15 per cent. in ordinary practtice. The slag overflows continuously from the forehearth and it passes directly to the dump. A long series of tests has shown that its average assay is less than 0.1 per cent. copper.

The first fusion by any one of the above three forms usually eliminates 85 per cent. of the total ore tonnage, and the product consists of copper, gold, silver; some of the iron and some of the sulphur.

This matte, usually about 15 per cent. of the ore tonnage, is then treated, in the secondary stage of the process, first for the elimination of the remaining iron, and second to expel the remaining sulphur, on a basis that becomes a source of profit, in lieu of the present expensive method of lining many shells with crushed silica flux.

The molten matte is transferred, preferably by gravity, in suitable charges, into one or more secondary converters, the number of which is governed by the size of the primary converter. In these secondary converters, ore charges preferably also preheated as before described, are fed into the intensly basic matte while converting is in full progress; such. for instance, as highly silicious Butte ore, quartzose gold or silver ores, etc.

Butte ores may thus be dissolved, in large charges, and the resultant slag skimmed off in 15 minutes. The rapidity of the action is astonishing. Ores carrying 20 per cent. of zinc are successfully treated.

When it is desired to treat flue dust or fines, the best results are obtained by placing a mass of these, without previous preparation, in an empty secondary converter; running a layer of molten matte or slag over them in order to seal them to the bottom and side walls of the vessel; running a body of molten matte thereafter into the vessel and melting them down by the heat of converting.

The converter slag varies in value. As long as the ore feed continues it may run quite low. When it ceases and the bath is rapidly enriched to the grade of white metal, the slag becomes constantly richer. All of this slag, without regard to tenor, is transferred in molten form into the feed end of the primary converter, through an aperture provided for that purpose.

In the secondary converter the matte is enriched preferably to the grade of white metal, or say 76.5 per cent. copper; or in other words, to the point where all iron has been eliminated. Blister copper may be made in this converter, if desired.

The service on both the primary and secondary converters is severe, because of the low grade matte treated in each. Special apparatus has been designed to withstand this.

The product of the secondary converter may be transferred into a 4-ton converter, lined preferably with 12 in. of good silica brick. Owing to the absence of iron at this stage the silica lining is not attacked and this converter remains constant in size. A comparatively mild air blast is used and the sulphur is eliminated slowly.

The blister copper produced in this operation is refined electrolytically in the ordinary manner, but if free from gold and silver it may be refined in a special furnace.

The process is covered by a large number of patents.

Mr. Heywood's report, which is dated Feb. 5, 1906, follows:

I beg to submit the following report of smelting operations at the Pittsmont smelter at Butte, Montana, since I took charge of the plant as smelter manager, August 18, 1905.

Smelting—Previous to my arrival Geo. F. Beardsley had been engaged for about six weeks on experiments in pyritic smelting. He had abandoned these, the quantity of Butte silicious ores on hand being far in excess of the pyrrhotite required to continue using the pyritic process to advantage. The silicious ore from No. 2 shaft, of which there were several thousand tons on hand, had approximately the following composition: Silica, 52 per cent.; iron, 14; sulphur, 17; alumina, 7;

magnesia, 1; zinc, 2; copper, 2 to 4 per cent. The pyrrhotite that was being received from the company's mine at Spring Hill, near Helena, Montana, varied between the following limits:

	1st Class.	2d Class.
Silica	9 per cent.	30 per cent.
Iron	48 "	31 "
Sulphur	32 "	13 "
Lime	5 "	23 "
Copper	None.	None.
Gold	$7 per ton.	$2 per ton.

To smelt the Butte silicious ore pyritically with the this pyrrhotite would take twice as much pyrrhotite as silicious ore. As there was no copper in the pyrrhotite, the resulting matte would be very low. This matte was to be treated by the Baggaley process and used as a solvent and flux for silicious ore, so it was immaterial what copper it contained; but, having a large quantity of silicious ore on hand, and the supply of pyrrhotite being limited, it was considered advisable to abandon pyritic smelting and adopt a partial pyritic charge, using silicious ore and pyrrhotite in about the proportion of their supply and adding limestone for the base required for proper slag formation.

The blast furnace used was made of cast-copper water jackets, 38x158 in. at the tuyeres. It has fourteen 3-in. tuyeres on each side. The distance from tuyeres to the charge floor is 9 feet.

The materials smelted since Sept. 1, 1905, are as follows:

	Days in Blast.	Tons Lime Rock.	Butte Ores.	Pyrrhotite.	Matte.	Converter and Blast Furnace Slags.	Total, Tons.	Coke used.
Sept.	22	775	2097	1495	180	170	4717	528
Oct.	31	933	3053	1307	835	624	7078	637
Nov.	25	814	2788	1235	584	302	5723	474
Dec.	31	1143	3551	1631	112	262	6699	606
Jan.	31	1316	3589	1389	200	166	6660	664

The average of the slag and matte is as follows:

	Matte	Slag			
	% Cu.	% Cu.	% SiO.	% FeO.	% CaO.
Sept.	8.6	0.11	46.1	21.1	20.4
Oct.	20.9	0.24	44.0	28.9	16.6
Nov.	20.6	0.24	42.2	29.7	17.2
Dec.	24.2	0.24	43.6	25.5	18.7
Jan.	28.2	0.21	43.8	21.9	21.4

These slags also contain 7.5 per cent. Al_2O_3; 2.5 per cent. MgO; 2.5 per cent. ZnO; and 0.5 per cent. S.

No effort was made to obtain a high rate of concentration in the blast furnace. Employing pyrrhotite as a flux reduced the grade of the resulting matte, but lowered materially the amount of coke necessary to smelt the mixtures and the copper lost in slag. It will be noted that these slags are the cleanest ever produced from Butte ores. As our matte was treated in a basic lined converter, using silicious ore as a flux, this low-grade matte produced in the blast furnace was not a source of expense in converting as it would be if an ordinary silica-lined converter were used. It might be argued that this occasioned greater loss in converter slags on account of the greater volume of slag made in the converter from these low-grade mattes. The converter slags, from November onward, were poured in the molten state into the blast furnace, consequently the assay of the blast-furnace slags included the copper loss of the converters. It will be noted that 624 tons of converter slag were smelted during October. During this month the slag from the converters was cooled, broken up and added to the blast-furnace charge. During November, December and January the tonnage of converter slag is much less, as no account is taken of the molten converter slag poured through the blast furnace. The slags weighed during these months represent the "hulls" left in the ladles and the necessary cleaning up about the converters and blast furnace. The amount of slag made per ton of ore smelted varied with the different charges from 1900 lb. to 2300 lb., and the slag loss is from 5.4 to 6 lb. per ton of Butte silicious copper ore smelted.

The extraction of copper in the blast furnace has been about 90 per cent. Taking the Butte ore at 4 per cent. copper, this would produce 320 lb. of 25 per cent. matte per ton of ore. The iron in this matte when fluxed with Butte ores would form about 300 lb. of converter slag. As this slag was discharged at 0.24 per cent., the loss of copper in converter slag equals 0.72 lb. copper per ton of ore smelted in the blast furnace, or a total smelting loss in both blast furnace and converter of less than 7 lb. copper per ton of ore smelted.

I have not taken into account flue-dust losses, as with proper dust chambers and flues the losses in this way are very small and are no greater by our method of treatment than by the older plan of treatment.

At this point it may be interesting to compare our loss of 7 lb. copper per ton of ore smelted with some of the results of other smelters.

At Granby, with self-fluxing ores and a charge of nothing but ore and coke in the blast furnaces, I am informed that the blast furnace slag loss is 7 lb. of copper per ton of ore smelted.

At the plant of the Tennessee Copper Company, with a low-grade cupriferous pyrrhotite, using barren quartz for flux and a double pyritic smelting, the loss of copper is about 9.4 lb. per ton of ore smelted.

What the copper loss is in the treatment of Butte ores by other companies is difficult to determine. Neither the Amalgamated nor the Montana Ore Purchasing Company publishes any data regarding its extraction of metal. We know, however, that a 4 per cent. copper ore, such as we have been smelting, would be consigned to the concentrator and the best saving claimed for water concentration in the Butte district is 80 per cent. of the copper. On this basis 16 lb. of copper would be thrown away in tailings. In other words, they lose more than twice as much copper before they start smelting as we do during our entire process.

The following are the points of difference between our blast-furnace practice and that of other companies treating Butte ore :

(1) We smelt directly our low-grade ores. Others separate their ores and send the high-grade ore to the blast furnace and the low-grade to the concentrator. The standard of what constitutes first-class ore is gradually being lowered and is now about 5 per cent. copper ore or over. This lowering of the standard indicates the trend of metallurgists to avoid the wasteful practice of water concentration.

(2) We employ pyrrhotite ores for flux. If this is obtained carrying values it is a much cheaper flux than barren limestone, as it materially reduces the quantity of coke required to smelt the charge.

We produce a low-grade matte in the blast furnace and thereby make the cleanest slags and the lowest copper losses in slag ever obtained from Butte ores. The employment of a basic lined converter and the smelting of silicious ores in the converter as flux for the iron in these low grade mattes enable us to convert profitably low-grade mattes, where the cost of continually relining a silica lined converter would be prohibitive. Since the other Montana companies started lining their converter shells with ore and adding silicious ores to the converter charge, there has been a gradual reduction in the grade of matte it is profitable to convert and consequently a diminution in the blast furnace slag losses.

(4) All our converter slags, except the small proportion that chills in the ladles, is poured molten into the blast furnace. This cleans the slags by allowing the matte particles contained therein time to settle, and has a beneficial effect in the blast furnace by scouring it out and saves the cost of handling and resmelting.

Converting—From the time of my arrival in Butte until Oct. 7 the converter plant was not used. The old vertical blowing-engine having broken down, a new horizontal cross-compound Reynolds blowing-engine was purchased and installed. The blast furnace matte made up to Oct. 7 was either sold to the Montana Ore Purchasing Company or stored. The converter employed in the Baggaley process is composed of steel rings 11 in. thick and 24 in. wide. It is lined with one course of 9 in. of magnesite brick. The cap is not lined. The total length of the converter is 13 ft. The length inside the brick lining is 9 ft. 6 in. The outside

diameter of the converter is 8 ft.; the diameter inside the lining is 4 ft. 9 in.

The method of operating is as follows: About 1000 lb. is placed in the converter and a top of four or five tons of low-grade matte is poured in. The charge is then blown with the addition of charges of ore in 1000 lb. lots until the matte is "high," i.e., the iron has been eliminated. The slag is then poured off and a fresh tap of matte added with more ore. When it is desired to finish a charge, the white metal in the converter is blown to copper in the usual manner, without the addition of ore.

The converter works freely and quickly. and its large size permits of large quantities of matte being handled. With matte containing 10 per cent. copper I have added 60 tons before finishing and kept the charge blowing for 48 hours before pouring copper. With matte containing 30 per cent. copper we have finished a charge in three hours. The size of the copper charges poured depends, of course, on the grade of the matte and the number of taps added; we have finished charges of less than a ton of copper and also charges of seven tons of copper. As the lining remains the same size there is much greater freedom and elasticity in the sizes of charges than with a silica lined converter.

From Oct. 7, 1905, to January 31, 1906, we have made over 480 tons of copper. The same magnesite lining that was in the converter when I came is still in use, The only repairs have been the renewal of some of the bricks about the tuyeres, on four occasions, when they had become dislodged or broken by the punching of blocked tuyeres. Our blast furnace being small and our ores low-grade, we have been unable to keep the converter supplied with matte. If we had all the matte the converter would handle it would turn out over 500 tons of copper a month. As our matte is much lower grade than any one else attempts to convert, to the best of my knowledge, this is better work than I ever heard of a silica lined converter accomplishing.

With a silica lined converter I do not think that more than five tons of copper from this low-grade matte could be made before the converter would require relining. That is ninety-six times the converter would be lined for our 480 tons of copper. The labor and power used in relining is at least $10 per shell, so the saving in labor of relining alone is $960 up to January 31.

We have smelted 938 tons of silicious ore in the converter at practically no cost.

The labor required on each shift is one skimmer, one puncher and one helper. The converter has given less trouble than any converter I ever ran, although I had never before attempted this method of converting, and almost the entire force of men were inexperienced in converting in a basic lined converter.

The following table shows the amount of Butte silicious ore (50 per cent. SiO_2 and 14 per cent. Fe.) required to form a converter slag of 30 per cent. SiO_2 and 60 per cent. FeO with five tons of copper mattes of various grades:

Per Cent Copper in Matte.	Ore Required.
5	9350 lb
10	8700 lb.
15	8050 lb.
20	7450 lb.
25	6800 lb.
30	6200 lb.

The desirability of using a basic lined converter and introducing the necessary silica by some other means than the destruction of the lining has been recognized since the introduction of the Bessemer process in treating copper mattes. Until it was successfully accomplished at the Pittsmont smelter it has never been done.

Hermann Keller, while superintendent of the Parrot smelter, Butte, about 1890, attempted converting in a magnesite lined shell. A record of his attempts and failures, written by him, is given on pp. 570, 571 and 572 of Peters' "Modern Copper Smelting" (seventh edition, 1895). The three reasons given by Mr. Keller why a basic lined converter was a failure and the process abandoned at the Parrot have never been in evidence, at the Pittsmont, in the Baggaley converter. Taking the three reasons **separately:**

(1) The outside of the converter has never been "dangerously hot." Considering the grade of the mattes treated, the converter works much quicker than any silicia-lined converter I have ever used.

(2) We have never experienced any difficulty in adding silicious ores to the converter in such a manner that it would combine with the ferrous oxide.

(3) As the same lining has lasted four months, and is still in service, there cannot be any "shelling" of the magnesite brick worth attention. Moreover, if the magnesite lining were now completely destroyed, it has paid for itself in the saving of labor alone required in relining silica converters.

General Results—At least 10,000 tons of copper is now mined daily in Butte. Probably 2500 tons is considered first class and smelted directly in the blast furnace. The remainder, 7500 tons, is consigned to the concentrators for water concentration. This ore averages over 3 per cent. copper, consequently the loss of 20 per cent, of the values in tailings entails a daily loss of over $15,000 before smelting commences. This loss represents at least $2 per ton of second-class ore treated, or nearly double the smelting cost at Tennessee or Granby. In order to obtain water to wash 20 per cent. of the values away, most of the ore has to be hauled by railway to Anaconda and Great Falls. The concentrate, containing the 80 per cent. of the mineral saved, is too fine for pyritic smelting in the blast furuace and contains too much sulphur for reverberatory smelting; consequently it is roasted. This roasting is a waste of the fuel (sulphur) contained in the ore, in addition to the expense of the operation. The roasted concentrate is too fine for the blast furnace, so it is treated in reverberatory furnaces. Reverberatory smelting is not only more costly than blast-furnace smelting, but the losses in slags are much greater.

I am informed by E. H. Hamilton, assistant manager of the Washoe smelter at Anaconda, which treats 7000 to 8000 tons of Butte ore daily, that they have tried smelting in their blast furnace a mixture of all their Butte ores in the proportion they were received for a year, with very satisfactory results. He obtained a 50 per cent. matte, as lime was used as a flux. If iron sulphides were employed to replace part of the lime the loss in slags would have been lowered, as the blast-furnace matte would have been of lower grade and the coke consumption materially reduced.

In "The Mineral Industry" for 1901, p. 698, Dr. Franklin R. Carpenter states:

I have smelted many thousand tons of Butte copper ores at the Deadwood plant and have no hesitancy in stating that the whole of the concentrating and roasting machiery employed around the Montana smelting works is unnecessary, provided the process of pyritic smelting is employed that was first developed at Deadwood, S. D.

Considering the studies in pyritic smelting since 1901, and in view of our experiments, how much more wasteful and unnecessary does the present method of water concentration and roasting appear?

To treat Butte ores pyritically a large amount of iron sulphide ore would necessarily be employed. When the large amount of first-class ore is considered, much less iron and lime would be needed than we have employed in treating only the lowest grade and most silicious of Butte ores. Whether it would be more profitable to bring iron ores to the copper ore or haul the copper ores over the mountains to obtain water to wash away 20 per cent. of their value, can easily be demonstrated.

Without iron sulphide ores, and using only limestone for flux with what iron ores of any kind that can be obtained, the treatment of Butte ores in blast furnaces and converters has been demonstrated to be more economical than the methods now employed by all companies in Montana except the Pittsburg & Montana Copper Company.

The chief producing copper mines of Alaska at present are close to the coast, where ocean freights to the Tacoma smelter, Washington, are low. Last year the Ellamar mine, in the Prince Wllliam Sound district, shipped 2000 tons of ore per month to Tacoma. Several mines on Prince of Wales Island were also shippers.

Patents Relating to Mining and Metallurgy.

UNITED STATES.

The following is a list of patents relating to mining and metallurgy and kindred subjects, issued by the United States Patent Office. A copy of the specifications of any of these will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. In ordering specifications correspondents are requested to name the issue of the JOURNAL in which notice of the patent appeared.

Week Ended Mar. 13, 1906.

814,666. DRYING APPARATUS.—Wilhelm Bell, Burgbrohl, Germany. Filed Aug. 23, 1904.

814,692. MERCURIAL ALKALINE PROCESS.—Willis E. Harmon, Mechanic Falls, Me., assignor to American Electrolytic Company, Philadelphia, Pa., a Corporation of Delaware. Filed July 6, 1905.

814,698. GAS-PURIFIER.—Franklin G. Hobart, Beloit, Wis., assignor to Fairbanks, Morse & Company, Chicago, Ill., a Corporation of Illinois. Filed Apr. 20, 1905.

814,710. COAL UNLOADING, BREAKING, and Loading APPARATUS.—Walter T. Krausch, La Grange, Ill. Filed Sept. 18, 1905.

814,726. VACUUM ELECTRIC FURNACE.—Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Filed July 23, 1903.

814,727. ELECTRIC PRESSURE FURNACE.—Henry N. Potter, New Rochelle, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Filed July 23, 1903.

814,728. CONTINUOUS STEEL-BILLET-CASTING MACHINE.—Oscar Potter, Wilmington, Del. Filed Sept. 26, 1904.

814,768. EXPANSION-BIT FOR COAL-DRILLS.—William H. Clarkson, Edwards Station, Ill., assignor to Eluide J. Clarkson, Edwards Staton, Ill. Filed Jan. 30, 1905.

814,769. CUPOLA.—Fred N. Cline, Chicago, Ill. Filed Oct. 24, 1904.

814,773. METHOD OF FEEDING GLASS.—Henry L. Dixon and George A. Marsh, Pittsburg, Pa., assignors to Automatic Machine Glass Company, Pittsburg, Pa., a Corporation of Pennsylvania. Filed Dec. 5, 1904.

814,774. APPARATUS FOR SHEARING GLASS.—Henry L. Dixon and George A. Marsh, Pittsburg, Pa., assignors to Automatic Machine Glass Company, Pittsburg, Pa., a Corporation of Pennsylvania. Filed Mar. 10, 1905.

814,810. METALLURGICAL PROCESS.—Frederick T. Snyder, Oak Park, Ill. Filed June 23, 1905.

814,814. AMALGAMATING PROCESS.—Herbert A. Thomas, Chicago, Ill., assignor to Dry Amalgamation Co., Chicago, Ill. a Corporation of Arizona. Filed Aug. 22, 1904.

814,832. CRUSHING-MILL.—Gotthard Commichau, Magdeburg, Germany. Filed June 17, 1905.

814,836. PROCESS OF COPPER SEPARATION.—Alexander Elliott, Littlerock, Cal. Filed Dec. 19, 1904.

814,856. MINING-DRILL.—Frank Lonski, Plymouth, Pa. Filed Oct. 19, 1905.

814,864. ELECTROLYTIC APPARATUS.—Frank McDonald, Roaring Spring, Pa. Filed Apr. 27, 1905.

814,896. ORE-CONCENTRATING APPARATUS.—John F. C. Abelspies, Charlestown, England. Filed Aug. 15, 1904.

814,917. PROCESS OF MAKING NITRIC ACID FROM AIR.—Arthur Pauling and Harry Pauling, Bismarck, Germany; assignors to The Firm of Chemische Fabriken Gladbeck, Gesellschaft mit Beschrankter Haftung, Gladbeck, Germany. Filed Mar. 24, 1904.

814,940. EXTRACTION VESSEL.—Clarence M. Chamberlain, Lead, S. D. Filed May 31, 1905.

814,952. VIBRATING SCREEN.—Norman V. Fitts, Denver, Colo., assignor to The Colorado Iron Works Company, Denver, Colo. Filed Dec. 5, 1904.

814,961. PULVERIZING-MILL.—Edward H. Hurry, Bethlehem, Pa. Filed Dec. 13, 1898.

814,983. PNEUMATIC HAMMER.—Reinhold A. Norling, Aurora, Ill., assignor to Aurora Automatic Machinery Company, Aurora, Ill., a Corporation of Illinois. Filed May 31, 1905.

815,002. DRILL.—Lewis W. Baney, Frank E. Baney, and John Osterholt, Platteville, Wis. Filed June 6, 1905.

Week Ended Mar. 6, 1906.

814,009. MEANS FOR OPERATING THE GATES OF COAL-TIPPLES.—Luther E. Armentrout, Coaldale, W. Va. Filed Aug. 4, 1902.

814,019. GOLD-DREDGE.—Horace J. Clark, Boise, Idaho, assignor to The Clark Dredging Company, Chicago, Ill., a Corporation of Nevada. Filed Mar. 20, 1905.

814,050. ELECTRICAL SMELTING PROCESS.—Woolsey M. Johnson, Iola, Kans. Filed May 24, 1904.

814,049. METHOD OF TREATING MATTE.—Woolsey M. Johnson, Hartford, Conn. Filed May 27, 1903.

814,072. APPARATUS FOR ELEVATING LIQUIDS.—Harry C. O'Bleness and Erwin C. Merwin, Athens, Ohio. Filed May 17, 1905.

814,085. ORE AND COAL CRUSHING MACHINE.—John F. Sauerman, Russellville, Ark. Filed July 3, 1905.

814,204. DREDGER.—Nicholas R. Harris, San Francisco, Cal. Filed Oct. 28, 1905.

814,231. DUMP-CAR.—Spencer Otis, Chicago, Ill., assignor to National Coal Dump Car Company, Rapid City, S. D., a Corporation of South Dakota. Filed Oct. 1, 1904.

814,241. MINER'S LAMP.—Frank A. Smith, Victor, Colo., assignor of one-third to George W. Thomas and one-third to Henry Buckley, Victor, Colo. Filed Apr. 20, 1905.

814,249. GAS-PRODUCER.—James H. Swindell, Pittsburg, Pa. Filed Dec. 13, 1904.

814,270. DREDGING-MACHINE.—Charles E. S. Burch, Seattle, Wash. Filed July 12, 1904.

814,271. APPARATUS FOR HANDLING COAL, ETC.—Jeremiah Campbell, Providence, R. I. Filed Jan. 14, 1905.

814,273. ORE-CAR.—Andrew Christianson, Butler, Pa., assignor to Standard Steel Car Company, Pittsburg, Pa., a Corporation of Pennsylvania. Filed Oct. 23, 1905.

814,279. APPARATUS FOR PRODUCING GAS.—Carleton Ellis, White Plains, N. Y. Filed Oct. 21, 1905.

814,294. PROCESS FOR THE RECOVERY OF PRECIOUS METALS FROM ORES, ETC.—John A. Just, Pulaski, N. Y., assignor to The Just Mining & Extraction Co., Syracuse, N. Y., a Corporation of New York. Filed Mar. 25, 1905.

814,299. ROASTING-FURNACE.—Frank Klepetko, New York, N. Y. Filed Nov. 6, 1905.

814,312. PUMP.—Ennis M. Nevins, Beaumont, Tex., assignor to Acme Manufacturing and Supply Company, Beaumont, Tex. Filed Jan. 4, 1905.

814,334. PROCESS OF RECOVERING TIN OR TIN AND LEAD.—John C. Taliaferro, Baltimore, Md., assignor to Continental Can Company, New York, N. Y., a Corporation of New Jersey. Filed Mar. 27, 1905.

814,360. CRUDE-OIL BURNER.—Edwin Darby, Iowa City, Iowa, assignor of one-half to Benjamin J. Hardy, Iowa City, Iowa. Filed Dec. 8, 1903.

814,365. WELL-PUMP.—Alfred T. Evans and Vernon C. Gahagan, Guffey, Pa.; said Gahagan, assignor to William A. McGregor, Guffey, Pa.

814,412. COKE-HANDLING APPARATUS.—Edward N. Trump, Syracuse, N. Y. Filed Mar. 24, 1902.

814,452. METAL-LEACHING PROCESS.—Thomas B. Joseph, San Francisco, Cal. Filed Aug. 23, 1904.

814,506. FURNACE-CHARGING MECHANISM.—David Baker, Wayne, Pa., assignor to one-half to Albrecht B. Neumann, Joliet, Ill. Filed Nov. 1, 1904.

814,557. APPARATUS FOR THE TREATMENT OF ORE FOR THE MANUFACTURE OF IRON AND STEEL THEREFROM.—Montague Moore, Melbourne, and Thomas J. Heskett, Brunswick, Victoria, Australia. Filed Aug. 15, 1904.

814,583. APPARATUS FOR FEEDING ELECTROLYTIC CELLS.—Frank J. Briggs, Everett, Mass. Filed May 9, 1905.

814,590. LINK OF BUCKET DREDGING MACHINERY.—Robert R. Douglas, Dunedin, New Zealand. Filed Mar. 14, 1905.

814,597. RECIPROCATING TOOL OR ENGINE.—Charles A. Faessler, Buffalo, N. Y. Filed Nov. 21, 1903.

814,618. DREDGING-BUCKET.—Charles A. Morris, Bloomfield, N. J., assignor to Hayward Company, New York, N. Y., a Corporation of New York. Filed Oct. 27, 1905.

814,621. COKE-OVEN.—Geremia Pierboni and Pasquale Bufano, Connellsville, Pa. Filed Oct. 14, 1905.

814,650. AIR-FEEDING DEVICE.—Emro Harcharick, Wilkes-Barre, Pa. Original application filed Apr. 1, 1904.

GREAT BRITAIN.

The following is a list of patents published by the British Patent Office on subjects connected with mining and metallurgy.

Week Ended Feb. 24, 1906.

28,019 of 1904. BRIQUETTING IRON ORE.—W. Shumaker, Osnabruck, Germany. For the purpose of binding fine iron ores into briquettes mixing the ore with very finely divided quartz and lime and submitting the briquettes to steam pressure, the action of the steam on the intimately mixed powdered quartz and lime being to form the colloidal silicate of lime, which is an efficient binding material.

1821 of 1905. CONCENTRATING ORE.—Sulman, Picard & Ballot, London. The inventors add a small proportion of alkali, soapy matter, or other substances that diminish the surface tension of water, to the water used in grading, vanning or buddling ores, the addition being for the purpose of increasing the efficiency of the separation.

14,782 of 1905. ELECTRIC WELDING.—Clinton Wire Cloth Company, Clinton, Mass. An improved electric welding apparatus which will simultaneously effect any number of welds with the use of only one electrical controller for the series of welds.

22,935 of 1905.—COAL CUTTER.—Westfalia Company, Gelsenkirchen, Germany. In coal-cutting machines, of the percussive type, improved method of mounting the drill, so that it can be turned in any direction and at the same time ensuring that the force of the blow is taken up equally by the working parts.

Week Ended Feb. 17, 1906.

3140 of 1905. COAL-CUTTING MACHINE.—J. Krolik, Rellinghausen, Germany. A hand worked coal-cutting machine consisting of a disc containing tools on its edge, combined with three rotating tool spindles working successively on the surface to be cut.

7803 of 1905. SEPARATION BY FLOTATION.—Sulman, Picard & Ballot, London. For the purpose of floating sulphides and so separating them from gangue, the inventors mine the ores with acidulated water, and add a small proportion of oleic acid. The whole mass is then violently agitated, and bubbles of air thus introduced into the pulp. On agitation being stopped, the metallic particles collect at the top in a froth or scum.

7915 of 1905. PYRITE SMELTING.—T. T. Best and S. A. Hollingsworth, Liverpool. In burning pyrites, especially that which decrepitates to any extent, the inventors give it a preliminary heat before introducing it into the burning chamber. In this way the flues do not get choked with pyrites smalls and dust.

8445 of 1905. INSOLUBLE ACETATE OF ALUMINUM.—R. Reiss, Charlottenburg, Germany.—The production of an insoluble acetate of aluminum, by boiling aqueous solution of acetate of aluminum with acetic acid.

8555 of 1905. BLAST-FURNACE LINING.—F. C. W. Timm, Hamburg. In order to preserve the linings of blast and other furnaces, the inventor introduces with the charge an easily removable lining.

13,690 of 1905. ELECTRIC FURNACE.—P. Girod, Paris. In electric furnaces, arranging the electrode in such a way, that the current will pass through the longest path possible.

17,890 of 1905. SILOXICON PROCESS.—B. Seaboldt, Salt Lake City, U. S. A. A method of making siloxicon into specified shapes, by heating with clay and carbonaceous matter to a temperature at which the clay melts, but below the melting point of siloxicon.

18,830 of 1905. WIPER.—H. Krieger, Dusseldorf, Germany. Improved wiping device for removing superfluous molten zinc from the insides of pipes, etc.

21,735 of 1905. CENTRIFUGAL SEPARATOR.—S. Fawns and F. E. Davies, London. A centrifugal machine for separating ores from solutions, in which the separated ore is continuously discharged without stopping the machine.

23,229 of 1905. IGNITER FOR SAFETY LAMPS.—O. M. Miller, Gelsen Kirchen, Germany. Improved method of igniting miners safely oil lamps without opening.

23,402 of 1905. ELECTRIC FURNACE.—P. Girod, Paris. Improvements in inventor's electric furnace, whereby a number of crucibles independent of each other can be arranged side by side.

Personal.

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

August Mathez is at present in Salt Lake City, on professional business.

W. B. Vanderlip, of New York, has gone to Spanish Honduras on professional business.

E. Faber, head of the E. Faber Pencil Manufacturing Company, New York, is visiting Mexico.

R. J. Grant and H. A. Shipman are at present in the Cripple Creek district on professional business.

J. H. Curle, of London, passed through New York, last week, on his way to China, Japan and Corea.

Dr Clemens Schlüter, who has long held the chair of a geology at Bonn University, will shortly retire.

L. E. Humphreys passed through Denver a few days ago on his way from Sonora, Mexico, to Salt Lake City.

C. W. Purington, who has been examining mining property near Wickenburg, Arizona, has returned to Denver.

Fred D. Fuller, of the Sumpter smelter, is in Baker city, Oregon, making contracts for ore for the season's run.

Daniel Guggenheim and S. R. Guggenheim were in Salt Lake City recently, and expect to remain there for several days.

E. E. Connery, of Minneapolis, Minn., has been visiting mining properties in which he is interested in Colorado, Utah and California.

Geo. W. Boggs, of the I. W. Anderson Syndicate, has just returned from a trip in the Thunderbolt camp, 110 miles out of Emmet, Idaho.

A Matthiesen, of Breckenridge, Colo., has gone to Chile, South America, where he will be connected with an American mining company.

W. R. Doty, of Boulder, manager of the Livingstone mine at Sugar Loaf, has returned from a mining and business trip to Buffalo, N. Y.

Norman Ebbley, one of the principal owners of the Phœnix group of mines in the Cœur d' Alenes, spent a faw days in Butte recently.

Robert W. Sayles, has donated $50,000 to Harvard University to establish a fund for the preparation and maintenance of a geological museum.

J. E. Hyslop, manager of the San Francisco del Oro mines, Mexico, has been elected president of the Parral Foreign Club, Parral, Mexico.

Dr. William Hallock, professor of physics, Columbia University, New York City, has been appointed dean of the faculty of pure science.

Rory McGilvray, a well known operator at Idaho Springs, Colo., has accepted a position as superintendent with a large mining company in Mexico.

G. W. Mabee, Jr., a mining engineer of Central City, Colo., has gone to Manhattan, Nev., where he has become identified with the Schwab interests.

Elliot H. Wilson, formerly an engineer for United Copper, has been retained by the American Copper Company as engineer. He will remain in Butte.

Capt. James Wilcox, superintendent of the Mass Consolidated Mine at Mass City, Mich., recently examined the Hermina mine, near Massey, Ontario.

Superintendent A. C. Sieboth of the Lake Superior & Arizona mine, near Florence, Ariz., recently visited Calumet, Mich., the headquarters of the company.

Dr. Lester Ward, who has been long connected with the United States Geological Survey, has been appointed professor of sociology at Brown University.

W. M. Cake, of Portland, Oregon, managing owner of the Mountain View mine in the Cable Cove district, near Baker City, has gone to the mine to start spring work.

J. J. Hartis, a well known mining man of Boulder, Colo., has gone to Nevada and California camps to examine mining properties in the interests of Eeastern investors.

T. R. Griffith, operating the Jessie mine in Summit county, Colo., and also interested in the Mainstay property in South Dakota, is making a business visit to New York City.

James W. Neill, consulting engineer for the East Butte Copper Company and the Pittsburg Company, who makes his headquarters in San Francisco, is in Butte on business.

S. E. Olson, of Minneapolis, has arrived in Deadwood, S. Dak., to take immediate action regarding the construction of the mill for the Reliance property, of which he is president.

E. T. Brooks, superintendent of the French Creek tunnel in Summit county, Colo., has resigned to accept a position with the Cashier Mining Company in Boulder county, Colorado.

Arthur W. Stevens, mining engineer, Chicago, is in Colorado, examining properties for the firm of E. E. Stelle & Co., of Chicago. From there he goes to old Mexico, for the same purpose.

J. H. Robeson, who is interested in the operations of the Sniuggler-Union mine at Telluride, Colo., has been making a visit to Georgetown, Colo., to look after interests in that silver camp.

W. L. McLaughlin, of Deadwood, S. Dak., manager of the Horseshoe Mining Company, has gone to Pittsburg to confer with the re-organization committee concerning the new plans for the mill.

Norman W. Haire, vice-president and general manager, has returned to Houghton, Mich., after attending the annual meeting of the Osceola Consolidated Mining Company in Boston.

N. M. Nelson, general manager of the Lincoln Mining and Milling Company, operating in Boulder county, Colo., has returned from a six weeks' business trip to St. Louis, Mo., and other eastern points.

H. Vincent Wallace has been at Hermosillo, Sonora, attending to metallurgical and analytical work for the Verde Grande Copper Company, which has been installing a Medbery furnace. He returned to Nogales recently.

John Boyd, President of the Aetna Securities Company and general manager of the Palmer Mountain Tunnel and Power Company, has lately been visiting the mines and has gone to Denver, Colo., whence he will return to New York.

Arthur C. Claudet, of London, becomes president of the Institution of Mining and Metallurgy, this month. His presidential address will be devoted largely to a history of the Institution and a plea for its strong support by the profession.

Capt Thomas Hoatson, of Calumet, Mich., has been appointed mining director of the Keweenaw Copper Company, which owns several thousand acres of mineral land in Keweenaw county, Mich., and is building a railroad through that section.

Hugh G. Elwes has been appointed metallurgist to the San Luis Mining Company, Panuco de Colorado, Mexico. He is at present conducting experiments with a view to converting the 100-ton hyposulphite leaching plant into a cyanide plant.

William Ballantyne has resigned the management of the Conqueror and Mint properties at Empire, Colo., and has gone to Manhattan, Nev., to look after the interests of the Benzie Investment Company of Denver. He is succeeded at Empire by William Prout.

J. E. Parker, of Memphis, Tenn., president and general manager of the Mary Verna and North American Mining Companies, operating at Frisco, Summit county, Colo., has been visiting the properties with a party of Southern capitalists who are interested in the companies.

Frank H. Haller, of Ironwood, Mich., for the past three years chief engineer for the Gogebic range iron mines of the Oliver Iron Mining Company, has resigned to accept an executive position directly under Superintendent Wm. Uren of the Osceola, Tamarack, Ahmeek and Isle Royale mines in the Lake Superior copper district.

Geo. A. Koenig, professor of chemistry at the Michigan College of Mines, has returned to Houghton, Mich., after visiting Inyo county, Cal., where he investigated the commercial possibilities of the alkali contained in the water of Owen's lake. The question as to whether additional works are to be established for obtaining this product will be decided by the experimental work Dr. Koenig is now conducting.

In our issue of March 10, page 482, was a note that J. H. Hendry had been appointed manager of the Velardeña Smelter in Mexico. This we are informed, is not correct, as his appointment is manager of the mining department of the Velardeña Mining and Smelting Company. E. C. Knight was appointed manager of the Velardeña smelter of the Velardeña Mining and Smelting Company last August. and since that time has been manager of the smelter at Velardeña, as well as of the Monterey plant of the American Smelting and Refining Company at Monterey. Mr. Hendry also still holds his former position of manager of the Esperanza Mining Company at El Oro, Mexico.

Obituary.

Samuel Hendy, manager of the Joshua Hendy Company, of San Francisco, died suddenly in that city March 14. He had been engaged for many years in the manufacture of mining machinery, and was well known on the Pacific Coast.

Henry S. Tyler died in San Francisco, March 11, from an attack of apoplexy. A New Yorker by birth, he went to the Pacific Coast many years ago, and was well and widely known in San Francisco where he made his headquarters. For some twenty years he represented THE ENGINEERING AND MINING JOURNAL in California, doing excellent work in that capacity. In 1904 he acted for the JOURNAL at the Louisiana Purchase Exposition in St. Louis. Soon afterward he severed the connection in order to give his time to his private interests. His death will be regretted by many friends, and by none more than by those connected with the JOURNAL, which he served so long and so well.

Captain John Pengilly, a well-known Lake Superior mine manager, died in Arizona from pneumonia last week, aged 53 years. As a conclusion to a long negotiation he left Duluth a few weeks ago to demonstrate the caving system of mining at the Green Consolidated copper mines at Cananea, Mexico. He was born in Cornwall, and secured his early training there. Coming to the United States he first worked in the Pennsylvania coal mines. Service on the Marquette and Gogebic ranges followed. Next he went to the Vermilion range, in 1888, and took charge of the Chandler mine. Positive of opinion in matters social and political, as well as mining, he attained great prominence and influence in the old days of the Minnesota Iron Company under Joseph Sellwood and D. H. Bacon. When the Oliver Iron Mining Company took control he remained for a time, but some two years ago resigned his position as manager of the Minnesota and Chandler mines.

Societies and Technicial Schools.

American Foundrymen's Association—Announcement is made of the tenth convention of the American Foundrymen's Association, to be held in Cleveland, Ohio, June 5, 6, and 7, 1906. An attractive series of papers has been promised. Special arrangements for entertainment are being provided, and all foundrymen are invited to attend. Richard Moldenke is secretary; his address is Watchung, New Jersey.

Trade Catalogs.

Receipt is noted of the following circulars and catalogs:

California Trade School, Los Angeles, Cal. Catalog, Plumbing. Pp. 12; paper, 5x7 in.

The Star Drilling Machine Company, Akron, Ohio. Catalog. Pp. 100, illustrated. Paper, 7x10 in. 1094.

Kingsford Foundry and Machine Works, Oswego, N. Y. Catalog, Kingsford Pumps. Pp. 46, illustrated. Paper 6x9 in. 1906.

Garvin Cyanide Extraction Company, 186 Morrison St., Portland, Oregon. Catalog. Pp. 15, illustrated. Paper, 6x9 in.

United Engineering and Foundry Company, Pittsburg, Penn. Catalog, Roll Turning Lathes. Pp. 12, illustrated. Paper, 9x10 in.

Harrisburg Foundry and Machine Works, Harrisburg, Penn. Catalog, A System of Engines. Pp. 57, illustrated. Paper, 6x9 in. 1906.

Vulcan Iron Works, Wilkes-Barre, Penn. Catalog, Engines, Mining Machinery and Locomotives. Pp. 28, illustrated. Paper, 7x10 in.

Ingersoll-Rand Company, 11 Broadway, N. Y. Catalog No. 45, Ingersoll-Sergeant Rock Drills. Pp. 96, illustrated; indexed. Paper, 6x9 in. 1906.

Buffalo Wire Works Co., 316-320 Terrace and 61-73 Jackson St., Buffalo, N. Y. Catalog No. 5. Pp. 111, illustrated; indexed. Paper, 8x11 in. 1904.

Marvin Electric Drill Co., Binghamton, N. Y. Catalog No. 4, Marvin Electric Rock Drills and Generators. Pp. 31, illustrated; paper, 6x9 in. 1904.

C. T. Carnahan Manufacturing Company, 1724 Lawrence St., Denver, Colo. Catalog, The Murphy Air Hammer Rock Drill. Pp. 21, illustrated. Paper, 6x8 in.

Allis-Chalmers Company, Cincinnati, Ohio. Bulletin No. 1049, Bullock Railway Generators for Direct Current. Pp. 19, illustrated. Paper, 8x11 in. January, 1906.

Union Iron Works, office 222 Market St., San Francisco, Cal. Catalog No. 5. Metallurgical and Mining Machinery. Pp. 164, illustrated; indexed. Paper, 7x10 in. Catalog No. 4, The Union Improved Ore Concentrator. Pp. 51, illustrated. Paper, 7x10 in.

Industrials.

The Traylor Engineering Company, of New York, has closed a contract for a large concentrating plant in Guatemala.

The branch office of the Ingersoll-Rand Drill Company, formerly located at Via Dolores No. 20, Mexico City, has been transferred to the establishment of Victor M. Braschi & Co., Cadena 2, who have taken the general agency for the above company for Mexico and have organized a new department, named the Ingersoll-Rand department, and have placed Mr. Juan Cuyas in charge of it as manager.

The Austin Manufacturing Company, Chicago, reports the following sales: Booth, MacDonald & Co., Christchurch, New Zealand—Crushing plants. Linwood Quarries Company, Davenport, Iowa—Crushing plant. John Gunn & Sons, Winnipeg, Canada—Crushing plant. American Trading Company, for Havana, Cuba—Crushing plant. Henshaw Bulkley & Co., for Hawaiian Islands—Crushing plants.

The Kennedy Valve Manufacturing Company, New York, has acquired a site for a new plant at Elmira, N. Y., about 20 acres. The plant will contain about 100,000 sq.ft., improved steel and brick construction, electrically operated, and will consist of iron and brass foundries, machine shops and other departments. The work of removing from present plant at Coxsackie, N. Y., will be gradual and by departments.

The Boyne City Charcoal Iron Company, Boyne City, Mich., is running on an average cast of 80 tons a day, and during its first year's operation had an output of about 25,000 tons. The fuel is obtained from the Boyne City Chemical Company, which furnishes most of the 6000 bushels of charcoal required daily. Noah W. Gray, of Marquette, Mich., is secretary and treasurer of the company, and Fred Smith is manager of the furnace.

The Colorado Iron Works Company, of Denver, Colo., has the contract to furnish complete equipment for a modern copper-matting smelting plant for the New World Smelting Company, of which Dr. G. L. Tanzer, of Seattle, Washington, is president. The new plant will be erected on the latter's property near Gardiner, Montana. The company also has an order for two sets 40x16-in. and four sets 30x10-in. Standard rolls, and 22 impact screens from the Pahaquarry Copper Company, of Bangor, Pennsylvania.

The Cyclone Drill Company, Orrville, Ohio, has purchased the plants, equipment, business, patents, good will, etc., of the Cyclone Drilling Machine Company and the Preslar-Crawley Manufacturing Company, and will continue the manufacture of the complete line of prospecting machines, water well, oil, gas and placer drills, blast-hole drills and "Economy" loaders, double-cylinder gasolene engines,

steam engines and boilers, engineering devices, etc. The present plant will be immediately enlarged.

The Main Belting Company, Philadelphia, manufacturer of the "Leviathan" belting, has enlarged its plant, to enable it to increase its output.

Joseph A. Silver, and his son, James W. Silver, have purchased the interests of the former's brothers, John A. and Hyrum A. Silver, in the Silver Brothers Iron Works Company at Salt Lake City. The new owners have commenced the construction of a large new plant, which will be furnished with up to-date tools. Nearly a hundred men are employed at the present shops, which were established in 1864 by W. J. Silver, who is still actively engaged in the business. Several prominent business men of Salt Lake City, among them L. S. Hills, president of the Deseret National Bank, are connected with the enterprise.

The new plant of the B. F. Sturtevant Company, at Hyde Park, Mass., was chiefly constructed in the Sturtevant works. In the power plant, the mechanical draft apparatus, the economizer, the engines and generators and the the exhaust head were built by the firm. The buildings are heated by the Sturtevant system, the shafting and individual machines are driven by motors of the same make, while the elevators and cranes are also equipped with Sturtevant motors. The removal of smoke from the forges in the smithshop is accomplished by a Sturtevant exhaust fan, as is likewise the dust from the grinding and buffing wheels, while Sturtevant blowers are used for brass and iron foundry, forge shop blast and the like.

The Harbison-Walker Refractories Company, Pittsburg, Penn., reports the sale of its products to the following: Bethlehem Steel Company, South Bethlehem, Penn.—Orders for all refractory materials required for new open-hearth furnace construction and two new blast furnaces, eight new stoves and connections. New Jersey Zinc Company, Palmerton, N. J.—All fire brick required for new blast furnace and four stoves. Milliken Brothers, Mariner's Harbor, Staten Island, N. Y.—Entire requirements of refractory material for five new basic open-hearth furnaces, soaking pits, heating furnaces, gas producers. New York State Steel Company, Buffalo, N. Y.—Entire requirements of refractory materials for two 200-ton "Talbot" furnaces with accompanying soaking pits, gas producers, boiler settings. Colonial Iron Company, Riddlesburg, Penn.—Complete blast-furnace lining. Dunbar Furnace Company, Dunbar, Penn.—Complete furnace lining and all brick required for a new stove. Central Iron and Steel Company, Harrisburg, Penn.—Complete lining for blast furnace. Colorado Fuel and Iron Company, Pueblo, Colo.—All brick required for blast-furnace lining.

Construction News.

Joplin, Missouri—Del Wise and others of Joplin are contemplating the building of a new 100-ton mill.

Webb City, Missouri—W. H. Darsham, of Webb City, will build a new 100-ton mill for the Minnie R. Mining Company.

Terry, South Dakota—A new mill is to be built by the Horseshoe Mining Company at Pluma. J. V. N. Dorr, Terry, is preparing the plans.

Alba, Missouri—The Crawdad Mining Company, operating on the Hannum & Hayworth lease at Alba, are contemplating plans for the erection of a new mill.

Montezuma, Colorado—The Pennsylvania Mines Company intends to enlarge its mill to 150 tons capacity, as soon as the new power plant is completed in Summit county.

Silver Plume, Colorado—The Dives-Pelican & Seven-Thirty Mining Company, of Silver Plume, is going to build an aerial tramway from the Pelican mine to the Dives-Pelican mill.

Porto Rico, Missouri—George B. Shattuck, president of the Commonwealth Mineral Company, operating at Porto Rico, will soon let the contract for the erection of four 250-ton concentrating plants.

Frisco, Colorado—The Mint Mining and Milling Company intends to equip its property with a 20-stamp mill, during the coming summer season, to be connected with the Colorado & Southern Road by a 500-ft. switch.

Loomis, Wash.—John Boyd, general manager of the Palmer Mountain Tunnel & Power Company, has gone to Denver, Colo., to examine a 100-stamp mill and also improved electric drills which he contemplates purchasing for use in the Palmer Mountain tunnel and lateral workings.

Baxter Springs, Kansas—A new and larger mill is now being contemplated for the Joanna mine at Baxter Springs, Kansas. R. L. Foster is superintendent.

Arrangements are now being consummated for the erection of a large and modern mill at the Ward mine at Baxter Springs, Kansas.

Elmira, New York—The Kennedy Valve Manufacturing Company is about to erect a new plant to be operated electrically, at Elmira, and informs us that any catalog, printed matter or information connected with construction or equipment of such a plant will be thankfully received by T. C. Flinn, care Chamber of Commerce, Elmira, N. Y.

Beacon Hill, Michigan—Crushing rolls as auxiliary adjuncts to the stamp heads, for use in crushing the oversize, will be installed by the Trimountain Company in its stamp mill. Additional concentrating machinery will be required. The office of the stamp mill is at Beacon Hill, Houghton county, Mich., and of the mine at Trimountain, Michigan.

Lyons, Colorado—The St. Vrain Power Company intends to invest between $500,000 and $600,000 in supplying electricity to Lyons, Longmont, Boulder and other valley towns. A reservoir is to be built 12 miles west of Lyons, a 54-in. main will convey the water to the electric plant, and the company expects to generate from 4000 to 5000 h.p. The address is at Lyons.

Houghton, Michigan—The St. Mary's Mineral Land Company, Dr. L. L. Hubbard, general manager, with offices at Houghton, Mich., has contracted with the Nordberg Manufacturing Company, of Milwaukee, Wis., for a 1200-ft. hoisting engine. The hoist will be installed at the Challenge mine, where sinking has been discontinued owing to the capacity of the present hoist having been reached.

The King Philip Mining Company, Dr. L. L. Hubbard, general manager, with offices at Houghton, Mich., has started a shaft and will develop its property adjoining the Winona. It is proposed to sink 1000 ft. and the usual equipment will be necessary, part of which is installed.

Leadville, Colorado—The Yak tunnel has installed one of the largest as well as the only electric air compressor in the State. The machine is a Leyner with a capacity of 800 cu.ft. per minute, equal to a steam engine power of 150 h.p. The compressed air is utilized to furnish power to operate drills, hoisters, pumps, blacksmith forges, power and machine fixtures.

The Boston-Arizona mill at the head of California gulch will be in running order within 10 days, and will treat the ore from the Fanny Rawlins, making a high-grade zinc product and a lead-iron concentrate carrying the principal gold and silver values of the crude ores. The mill to start with will have a capacity of 20 tons daily and if conditions permit can easily be increased to 200 tons daily.

Baker City, Oregon—H. H. Andrews, of Nebraska, is taking further steps to resume work on his Eagle Creek power plant which he started two years ago, 35 miles east of Baker City, for the purpose of furnishing electric light and power to Baker City and the various mines east of here. He expects to complete construction work this season.

Wheeler & Co. of New York, through their local manager, O. C. Wright, of Ontario, Oregon, announce that they expect to complete the electric railroad between Sumpter and Bourne this season, and that they also are negotiating for the building of a steam railroad from Ontario northeasterly through Payette Valley, Idaho, tapping an undeveloped country. Both roads will be used principally for mining purposes.

Special Correspondence.

Goldfield, Nev. March 17.

Of all the properties in the district that are attracting the notice of the public, the Great Bend is at present occupying a prominent position. According to recent reports the extensive trenching that has been done on the surface has exposed three distinct ledges, running parallel and less than 100 ft. apart. Assays made on different parts of the new strike show sensational values, and the property is now on the district's list of shippers. The find is interesting from a metallurgical as well as industrial standpoint, since upon analysis by local assayers the ore has been proven to contain considerable percentages of tellurium. For some time tellurium has been known to exist in slight amounts in the Quartzite, Daisy and Triangle, which lie in the same district; but previous to the strike on the Great Bend the element has not been reported in any considerable amount. The strike has had the natural effect on mining in the vicinity, both in an operative and speculative way; that is, a renewed activity in the development of adjacent properties, and a correspondingly active stock market.

The Florence is now making shipments of high-grade ore to the Globe smelter at Denver, while the second-grade ore is being sent to Miller's Siding to be sampled. Arrangements are now being made for the installation of the sampling machinery, which is on the way to Goldfield from the plant of the Allis-Chalmers Company, of Chicago.

Several weeks ago a body of milling ore was opened up on the Desert Rose claim of the May Queen Mining Company, and as it is drifted on the grade seems to be improving. Values are said to run about $25 per ton, with occasional assays which run much higher. The property lies west of the Sandstorm.

For several days the Nevada Leasing Company has had a force of men at work leveling off the dump and making other preparations for the installation of a gasolene hoist on their block of the Florence ground. The hoist is to be placed over shaft No. 1, and immediately following its erection underground development will be taken up on a more extensive scale.

The strike of a small streak has been reported on the Combination No. 2, in which good values are found. The shaft is now 180 ft. in depth, and when a depth of 200 ft. is gained, drifting will be commenced. The lease was formerly operated by Garret and associates.

On the Conqueror a shaft is being sunk to a depth of 50 ft., at which depth a drift is to run along the strike of the lead in search of a pay-shoot.

Charles M. Schwab and party recently passed through Goldfield on their return from Bullfrog, where he has made a personal inspection of his mining interests; particularly the Montgomery-Shoshone, his latest purchase.

The installation of new rolls and other machinery is taking place at the Red Top property in the sampling department, which will enable the company to conveniently sample a greater tonnage of ore than has been possible in the past.

The new shaft on the Senter lease on the Florence claim is now down 40 ft. and the lead shows better values than when first tapped. At a depth of 50 ft. a whim will be installed and prospecting continued.

The 10 stamps which were recently added to the equipment of the Combination mill are now in operation, and the company now has 20 stamps dropping with a capacity of about 70 tons per day. Further additions to the mill's machinery will soon be ready for use.

Tonopah. March 19.

The Nevada Alpine property at Lone Mountain, which has been operated so successfully for the past three years by the O'Meara-Lynch Company, is looking better than ever, and the ore reserves are being constantly expanded. The present output of the mine, with 20 men employed, is three carloads a month of an average value of $3500 a car.

F. A. Moore, superintendent of the South Mountain Mining Company, Reveille, which is developing a group of claims adjoining the Southwestern Nevada Mines Company's property, reports a big strike on the ground of this company. A large ledge has been uncovered and a good-sized streak of shipping ore is being developed.

For some months past experiments have been carried out at Reno, Nev., with a view of testing the suitability of the Pohle process for the treatment of Tonopah gold ore, with, it is reported, successful results.

Salt Lake City March 15.

A change in the directorate of the New England Gold and Copper Company, operating at Bingham, has been announced. E. E. Abercrombie, of Boston, recently became extensively interested in the property and was made managing director. The company is to put on a larger force and explore the orebodies below the present lowest tunnel level. The mine is equipped with a 50-ton mill, which is being operated successfully.

The Magnolia-St. Louis Mining Company has been organized to operate the St. Louis-Magnolia and June Bug groups at Park City. The incorporators are: Jas. McGregor, J. E. Frick, William C. Hall, of Salt Lake, and Frank McKeen and Adolph Herz, of St. Louis. Mr. McGregor is manager.

Dividends posted during the week were: Daly West, Park City, $108,000; Uncle Sam Con., Tintic, $5000; Utah, of Fish Springs, $1000; Grand Central, Tintic, $12,500; Beck Tunnel, Tintic, $15,000.

The pay-rolls of Tintic mines call for the distribution of about $100,000 monthly.

The Continental Alta Mines and Smelters Corporation, operating the Continental Alta mines at Alta, has filed an amendment to its articles of incorporation, reducing the capitalization from 500,000 shares of the par value of $10 to 150,000 shares of the par value of $10. Recent heavy snowstorms have retarded work of repairing the aerial tramway, seriously damaged not long ago by snowslides.

There are some big deals pending in Utah at the present time, and they involve several of the principal producing mines of the State. The next week may see some of them rounded out, especially those being sought by the Guggenheim Exploration Company. Daniel Guggenheim and others associated with him will arrive during the next few days.

Denver. March 16.

The news from Washington that the Department of Justice refused to reopen the Gore Cañon case was received here with a good deal of satisfaction, and the Denver, Northwestern & Pacific Railroad will now have the undisputed right of way through the cañon, which is five miles long. In it a tunnel 1100 ft. long will have to be constructed at the west end. David H. Moffat, the president, returned from New York a few days ago and announces that he has made satisfactory arrangements for the completion of the road to Salt Lake City. It has been settled that Steamboat Springs will be on the line.

Daniel Guggenheim, president of the American Smelting and Refining Company, accompanied by his brother, S. R. Guggenheim, spent a few days in Colorado and they have left for Salt Lake City, where the large new plant of the company is being built under the direction of Karl Eilers, and where they will meet John Hays Hammond and a number of his engineers, who have been for some time investigating numerous properties in Nevada and Utah. Important improvements at the plants in this State have been ordered during the past week at the meetings of the executive board.

The Colorado Iron Works of this city have received a large order for smelting machinery for the new independent smelter which is in course of construction at Ogden, Utah.

The graduating class of the Colorado State School of Mines expects to start before long on an instructive metallurgical trip through Utah, Idaho, Montana and the Black Hills.

Governor McDonald has furnished to Sheriff Rutan, of San Miguel county, a requisition on the Governor of Idaho for Vincent St. John, on the charge of the murder of Burnham during the strike troubles of three years ago. The requisi-

tion was honored and both are on their way to Colorado.

For the purpose of discussing the future plans of action in the matter of establishing headquarters for the American Mining Congress, a meeting of the committee on mines and mining of the Denver Chamber of Commerce was held, where 17 members were present. C. E. Dewey was elected secretary of the organization.

In the United States Land Office of this city the plats of surveys of the Denver, Yellowstone & Pacific Railroad have just been filed, and these show that the proposed new line will run from Denver to Fort Collins, thence up the Poudre valley to and across the line of Wyoming toward the Yellowstone country. According to the plats there will be about 120 miles in Colorado.

At a meeting of the Cripple Creek Chamber of Commerce it was suggested a few days ago that in place of the secretary of the Mine Owners' Association alone, having the power to issue or to revoke cards, a committee of three be appointed to pass on all applications for the same; this committee to consist of a member of the above association, a business man in the district and a miner. A committee of the Chamber will bring the matter up at the next meeting of the mine-owners' organization, for them to take action on the subject.

Cripple Creek. March 14.

As stated in the annual report of the Findley Consolidated Company, the greater part of the work has been discontinued. It was stated in the report that on account of the increased treatment charges since the first of the year production would cease from the property for a time at least. It is understood that a large amount of ore is broken in the stopes and also blocked out. It is stated that dividends will be paid as usual, however. The Shurtleff shaft of the company has been closed down entirely, and nothing but development work is going on in the main shaft. There seems to be a difference of opinion between the manager of this company and the representative of the smelters, with regard to the raising of rates of treatment, the former saying there has been a raise and the latter denying it. The public therefore have to judge for themselves as to the cause of suspending work. It seems certain, however, that the cause was not lack of ore.

The Forest Queen will install a small underground hoist on the fifth level to operate a winze which is being sunk on that level. Some ore is being shipped.

Negotiations are in progress, looking toward the consolidation of the Mary McKinney and Anaconda properties. It seems probable that this will be done. The Mary McKinney is being worked principally by the company, though some work is being done by lessees. The Anaconda is being worked entirely by lessees.

Interest is being taken in the coming annual meeting of the El Paso Consolidated Company. The company is doing the usual amount of work, and several of the lessees are doing well. Nearly a car of fair ore per day is being shipped from the Lambright lease on the Beacon Hill Ajax property of the El Paso Company.

Palmer and associates have taken a lease on the Robert Burns property on Guyot hill, and have commenced work sinking a shaft. It is the intention to sink to the depth of 300 ft. before doing any lateral work. The lease runs for three years.

Ground is being broken for the new compressor of the Golden Cycle, which is to be 40-drill capacity. The mine is looking very well at the present.

It is rumored that another mill is soon to be built in the district.

Leadville. March 16.

The amount of ore opened in the Yak tunnel has convinced the smelter trust that it would be advisable to lift the restriction on the monthly output and relieve the property of the ore congestion. During the week the Yak people were advised that the smelters would take an increase of 100 tons daily; this will bring the monthly output up to 11,000 tons. Experimental work has ceased at the Yak mill and it is now announced that the process is a complete success, and that the mill is now in a position to handle 300 tons of clean concentrates every 24 hours. The bulk of this ore will come from the tunnel, and a supply will be had from the A. Y. & Minnie and the Moyer.

The great importance of the Yak tunnel as a developer is again proved. M. M. Bohn and associates have secured a 10 years' lease on the Golden Eagle property, Breece hill. The men are well versed in the nature of the ground and the orebodies that it contains; they saw the disadvantages of working the property from the old shafts and concluded that the only practicable way was to run a lateral from near the heading of the Yak tunnel under the Golden Eagle workings. Contracts have been signed with the Yak people, who will drive the lateral and take away all waste and ore at a nominal price. The lateral will be 650 ft. in length and will cost $6500; when completed it will give the lessees 1200 ft. of stoping ground on the full length of the claim.

An interesting geological discovery was made during the week in the Ready Cash tunnel, Iowa gulch. The tunnel is in a little over 600 ft. and has from time to time shipped some rich gold ore, as well as silver and lead; the formation through which the tunnel passed was the usual Leadville formation, porphyry and blue lime. During the week, without any visible signs of a change, the tunnel ran into the granite with a fissure vein well defined between two walls, the vein being 8 ft. wide, with a pay streak from 8 in. to 1 ft. wide, and carrying from 2 to 3 oz. gold per ton; no silver or lead being in the pay streak. The change from a blanket formation to the granite was so sudden that mining men are not at present in a position to give an intelligent opinion, but are studying the matter. Only two instances are known in the camp where fissure veins were found in the granite—in the Greenback and Little Jonny, at a depth of 1300 feet.

The A. V. shaft, at the foot of Harrison avenue, will resume operations shortly under the management of W. S. Wells. When the property was last worked some very rich ore was shipped, but it was never found in place, and with the conditions then existing it was too expensive a proposition to sink. This is now changed, as the ground is practically unwatered, and it is more than likely that the shaft will be sunk to the lower zone.

Rapid progress is being made in the sinking of the Lou Dillon shaft, Iowa gulch, to the north of the Helena claim, as the ground is soft and hardly enough water is made to supply the boiler; when the requisite depth is reached cross-cutting will start and be carried in the direction of the Helena to cut that ore-shoot.

The lessees on the Matchless are shipping 300 tons monthly of a very fair grade of silicious ore; the shaft will be sunk another lift to the lower zone, the work to start at once.

The Bug Gold Mining Company, Big English gulch, has decided to drive the long proposed tunnel into the hill to open the body of mineralized contact opened above by shafts, and also to drain the hill. The mouth of the tunnel will be alongside of the South Park track. The strike recently made in Little English gulch holds out, and from the two shafts ore is being sacked that runs well in gold, silver and lead; another shaft was started during the week lower down the hill.

The lessees on the R. A. M. were compelled to quit work on account of the fire at the Mahala, but the gases are now well out of the property and work will be resumed this week. Fully 60 tons daily of a good grade of zinc will be shipped.

San Francisco. March 15.

The directors of the Independent Oil Producers' Association have been collecting statistics relating to the production, consumption and stocks of oil in hand. The claim is made that the stocks have been greatly overstated, and that contracts for future delivery have been made for which there is no provision. The consequences are, it is said, that there has been considerable active bidding for oil. Since the Associated Oil Company made a figure of 17½c. for oil in the Coalinga district

in Fresno county, a nominal cut of 1½c., some of the large producers have shut down. It is alleged that the Associated in turn refused to accept oil from these men, who are now in the independent movement. Later, the Associated needing oil for contracts, the independents were offered 17½c., then 19, but they have refused to make any deal, believing prices are going to strengthen. There is a belief among the producers that special concessions are being made, and that the price publicly quoted is by no means the price at which the bulk of the oil is being secured.

Considerable mining land has within the past six months been bonded on the Mokelumne river above Clements, 12 miles east of Lodi, and the land has been turned over to a mining company of San Francisco, which has placed a drilling outfit on the claims and will soon determine the amount of gold to be found. Seven miles above Clements on the Mokelumne, panning for gold has been going on for some time, with good success.

The case of the Royal Consolidated Mines Company versus the Royal Consolidated Mining Company, Ltd., to recover judgment for $340,000 against J. C. Kemp Van Ee, will be tried in the Superior Court of Calaveras county. The suit was begun there in November, but was temporarily suspended by the appointment of a receiver for the mine. An injunction preventing the receiver acting delayed the suit, but Judge J. J. De Haven has now granted a dissolution of the injunction.

The most recent mining excitement in the desert region of this State is in a direction north of Needles, San Bernardino county, near the Von Trigger claims, which are near the Santa Fe railroad branch running from Goff to Manvel. Gustave Vesñer and Jacob Heldeman have uncovered rock running up into high value in gold. These discoveries have excited all the miners in the camps in that section, and already some 1500 men are on the ground, with many more coming. Water is obtained only at springs two miles from the mines. The short time which has elapsed since the discovery naturally prevents development to prove the permanency of the veins. However, the prospectors are so numerous that the value of the find will soon be determined. In this connection it may be stated that there are reports of numerous murders of mining men in Death Valley and other desert regions of the State. It is true that remains of prospectors are frequently found—men who have perished from having lost their way and been unable to find water. Generally speaking, there is no necessity of carrying money into the desert regions, as no food supplies can be bought there, nor are there any stores or saloons. Men mysteriously disappear in the desert regions, but it is foolish to suppose they are murdered for their money. Few prospectors have much money in any case, even if there were need for it in such places. The different counties are now engaged in putting up metal sign-posts in the desert regions, indicating the direction and distance to water, proper trails or roads, etc. All this will save much hardship in the future and lessen the death roll.

The rangers in charge of the forest reserves in northeastern Shasta county are enforcing a rule which prohibits the old settlers from carrying their rifles across reserve property without the seal of the ranger. This rule has caused a great deal of dissatisfaction among the Shasta county men, who have been accustomed to all the freedom of the hills, and complaints are made. Old prospectors who have been for years in that section can see no sense in having a paper seal posted over the muzzle of their rifles when entering a forest reserve and then waiting on the other side to find a ranger to remove it officially. They consider this an infringement on their personal liberty. Some men who have been raising cattle near these reserves are selling out and moving away on account of this interference with their customs.

Butte. March 16.

A cold wave struck Butte four days ago and has interfered with mining to a considerable extent, especially in the mines of the Amalgamated. This interference was caused by the water in the large flume connecting Warm Springs creek and the Washoe concentrator becoming frozen in places, necessitating a partial suspension in the works. The company is keeping five of the eight sections of the plant in operation. All mines of the Anaconda, Washoe, Parrot and Butte & Boston were closed down Monday night because the bins were full of ore and the railroad company could not keep them from overflowing; but they will resume tomorrow. Boston & Montana, North Butte, United Copper and the Clark mines were kept in operation last night and today. The atmosphere is somewhat warmer than it was yesterday, and the companies do not anticipate further trouble. The Washoe has been receiving about 500 tons of ore a day from the Clark mines since the destruction of the Clark concentrator by fire. North Butte is raising between 850 and 900 tons of ore a day, and United Copper is mining about 1500. Steam has taken the place of water power at the Boston & Montana plant in Great Falls temporarily, the company having found it necessary, by reason of the freezing of the Missouri river above the plant. The water is almost entirely shut off. The company is handicapped somewhat by a shortage of railroad cars for the transportation of ore from Butte, but the railroad company is building 100 cars for service on the line.

All companies that have entered the Butte field recently are operating. One of the most promising of these is the Butte & Bacorn, which has 250 acres of ground two miles north of the city and has long-time options on 150 more. This company is backed by Pittsburg men, 40 of whom have subscribed $10,000 each for the development of the property. It is sinking four shafts, two of which will be put down far enough to determine the value of the leads, of which there are several of good width. The veins on the surface show splendid indications of copper. Some Butte men are interested, and have confidence in the outcome of the enterprise. If copper in commercial quantities is struck in this ground it will establish a new line for the copper zone, for the property is fully a mile north of the possessions of the North Butte. The company is not selling any stock, and has $365,000 in cash for its treasury.

Butte Copper Exploration and General Development are still pumping water from old workings on their properties, while Butte & London is sinking at the rate of 5 ft. a day. Its shaft is now down 125 ft. Some water has been struck, but not enough to interfere with work.

Reins Copper is down 1150 ft. and has 50 more to sink. Raven Copper is cutting its Snoozer veins on 1500 level, and has considerable good ore in sight. Columbus-Butte is making good progress on its new three-compartment shaft. It will ship about 100 tons of silver-gold ore this week. This company is after copper and will sink to a depth of 1200 or 1500 feet at least.

Joplin, Mo. March 22.

The American Zinc, Lead and Smelting Company, which is heavily interested in this district, is sinking two more shafts, 9x12 ft., on its property at Johnstown. It has one of the best producing properties in the district.

Robert Black and others have commenced sinking a shaft on the land of the National Bank of Carterville, west of Johnstown. They have nine drill holes on this lease, showing a 12-ft. face of ore.

The First National Mining Company at Porto Rico, whose mill burned some time ago, has completed a new 200-ton mill which was started last week.

The Pencil Frank Mining Company, operating on the Walker land at Duenweg, made its initial turn-in last week, amounting to 30,600 lb. of zinc ore.

J. W. Aylor and son, of Webb City, have purchased from the Smith heirs a tract of 342 acres of mineral land located about one mile south of Smithfield, northwest of Joplin. The consideration was $44,460, or at the rate of $130 per acre.

The Old Fort Mining Company, with head offices in St. Louis and a branch office in this city, has filed articles of incorporation extending 50 years, with a capital

stock of $40,000, in 400 shares of $100 par value each. S. H. Fullerton, W. B. Bash, W. H. Powell, John Powell, T. H. Bunch, John Hachmeister, J. P. Bennett, and H. Koehler, Jr., are stockholders.

The Federal Mining and Investment Company, of Joplin, has filed articles of incorporation extending 50 years, with a capital stock of $100,000, in 1000 shares of $100 par value each. Norton Thayer, L. R. Moore, Jr., C. L. Etheridge, J. E. Meyers and George T. Moore are shareholders.

O. W. Sparks, of Galena, and H. B. Henderson, of Columbus, Kansas, have purchased the Riverside mine at Badger. The consideration is given as $20,000.

A. H. Redding, J. H. VanHoose and S. F. Clark, all of Webb City, have encountered a body of ore in drilling on the Johnson land west of Joplin. They will drill several holes, thoroughly testing the lease before sinking a shaft.

Platteville, Wis. March 19.

A special meeting of the stockholders of the Wicklow Mining Company is called to consider ways and means of further development work. The Wicklow property is considered by well informed mining men to be above the average, but it seems to be the opinion of the majority that too much money has been spent above ground and not enough below.

Heretofore except in one or two instances all the prospect drilling has been done with the well known type of churn drill, which in a great many cases is unsatisfactory, owing to the loss of cuttings whenever a crevice of any size is encountered. It is reported on reliable authority that a company recently organized in Duluth intends to introduce a Davis calyx drill. The little diamond drilling done has proved very expensive owing to the peculiar crevice formation encountered in the ore horizons.

The West Empire, located in the Platteville camp, in which several mining men from the northern copper fields are heavily interested, has called for bids for hoisting and pumping machinery including a complete equipment. The company has recently opened up offices at Platteville. A strike made by Mr. Harding, of Duluth, on the Johnson property southwest of Platteville, owing to the fact that it is in virgin ground, no mining whatever has ever been done there, goes far to prove the claims of local mining men that the zinc is not entirely confined to the lower horizons of the old lead mines.

The pool that was recently formed to operate the property lying north of the Empire, has organized as the Broadway Mining Company. There are 50 shares, all owned by Plattevillle and Montfort mining men. It is thought that the Empire Range continues through the property.

The Koh-i-noor-Blende Mining Company has decided to install a 55-h.p. gas-producer power plant to operate the pumps and hoist. It is proposed, as soon as the power plant is installed, to put on three shifts to work night and day.

The rich lead strike at Fairplay camp, reported sometime ago in the JOURNAL, continues to improve as the drifts are extended. Minneapolis capitalists have secured control.

The promoters of the proposed electric lines, with which it is the intention to tap all the principal camps, are busily getting ready for business. Many of the mines are taking into consideration the possibility of securing electric power. The electric people claim that they can furnish power much cheaper than it can be produced by the operators in small units.

Henry Henkel, E. M. Lowry, C. S. Moore and other business men of Lancaster, Wis., are organizing a company for the purpose of taking up mining rights in Grant county. Sufficient subscribers have signed and as soon as their articles are filed, work will be pushed on by several of the different properties controlled by the new company.

Indianapolis. March 17.

Acute tension between the coal miners and the coal-mine operators marks the close of the miners' meetings preliminary to the joint conference which is to be held next week. There is little doubt that the conference will be held, though as yet no official communications have passed between the two bodies. The report of the miners' scale committee, adopted during the week, signifies their willingness to meet their employers. The operators who have arrived in Indianapolis are divided in opinion, some speaking of the joint conference as if it had really been arranged for, while others declare there will be no joint conference. It is generally believed, however, that there will be a conference. About 600 operators will hold their preliminary State meeting on Monday and if it is decided to meet the miners the joint conference will begin on Wednesday. The Indiana and Illinois operators are said to be opposed to going into a conference. Mr. Robbins is doing everything possible to induce the operators of the four competitive States to come around to his way of thinking and insists that the country will not sustain the operators in their refusal to go into conference.

President John Mitchell counseled conservatism upon the part of the Mine Workers and says they are ready to meet the bituminous operators for the purpose of endeavoring to effect a satisfactory settlement of the wage question. In this declaration they have shifted to the operators the burden of making the next move in the negotiations for a setlement. They have left it for the operators to meet them at least half way in a peaceable settlement of the contentions that now threaten the country with a paralysis of industry by a suspension of mining. Of course the miners rest at this time on the demands formulated in the January meeting and denied then by the operators in the joint conference that followed; which practically disrupted the interstate agreement. It now rests with the operators whether there will be a strike, since it is known, though not officially declared, that the miners are willing to drop their demands for a 12½ per cent. advance for the restoration of 1903 scale; and that the Ryan resolution will be repealed if a settlement can be had on that basis. The factional fight in the ranks of the operators will first be fought out. Many operators are resenting the right and authority of Mr. Robbins to make the alleged agreement with Mr. Mitchell to restore the 1903 scale. However, the more hopeful view of the situation is that a settlement will be effected during the coming week.

Birmingham. March 19.

Assistant State Mine Inspector M. M. Kuffner, in a report to the Governor on the colliery accident in Mine No. 2, at Piper in Bibb county, on March 1, asserts that there is little doubt that the explosion was caused by a "windy shot." The accident resulted in the loss of 11 lives, while 7 men were seriously injured. A little over a year ago, a windy shot in one of the Virginia City mines in this State caused an explosion, through which 111 men lost their lives. There have been numerous minor accidents from the same cause. A windy shot is one whose energy is partly or wholly expended in the air. It is usually due to bad tamping, deep holes, and cracks and crevices in the coal seam. The conditions which assist the flame caused by a windy shot in starting and extending an explosion are bad ventilation and dry coal dust on the floor of the workings and in the haulage ways.

The numerous accidents in the Alabama coal mines from explosions show that improved ventilation and adequate means for the removal of the dangerous coal dust are necessary. It is probable also, that there has been too free use of powder by miners. This was referred to in a previous letter.

This has been the contention of the State mine officials, who have long endeavored to have the mining laws improved. The recent accident at Mine No. 2, has shown the wisdom of the inspector's advice, and there is now a good prospect of the next legislature adopting an improved mining law, which will give the State inspectors fuller powers, and compel mine superintendents to improve the ventilation and underground conditions in coal mines.

Scranton. March 19.

A strike of a week's duration occurred at the Fernwood colliery of the Hillside Coal and Iron Company. A few of the men complained that the payment for mining coal was not satisfactory and asked to be placed upon the wages basis. This was agreed to, but when pay-day came around, they claimed that they were still being paid on the old basis. Thereupon they struck, compelling 500 men and boys to do likewise. The company posted notices that the colliery would be shut down indefinitely. Since that time the miners have met the officials and a settlement is expected this week.

About 100 men employed at the Twin shaft of the Lehigh Valley Coal Company went on strike on the ground that the mine cars had been increased in capacity, and claiming an increase in pay from 80 to 87c. a car.

About 500 men in the Horton mine of the Lehigh Valley Coal Company had a remarkable escape from drowning a few days ago. A miner fired a heavy blast, which blew a 5-ft. hole in the wall separating the mine from the abandoned mine workings. The latter were filled with water, which made its way rapidly into the gangways, where the men were at work. An alarm was successfully given and the men taken out of the mine, which at present is partially flooded.

According to the newspapers in the Schuylkill anthracite basin the mystery surrounding the purchases of the coal tracts in that region, during the past few months, has been solved by the report that the lands were acquired in the interest of the Wabash Railroad in connection with its strenuous efforts to establish the new Gould line to the Atlantic. Strange to say. there are many leading men in the anthracite region, who have been curious as to the big deals, who are now ready to give credence to the latest report. The Wabash road a few days ago asked for a franchise to build an elevated road on Market and Chestnut streets, Philadelphia, in the name of the new Philadelphia & Western Railroad. It is reported that this company will also invade the anthracite region and a franchise is being sought by an auxiliary company known as the Philadelphia & Schuylkill Railroad, which will extend from Sixty-third and Market streets, Philadelphia, through Norristown, Reading and Pottsville, parallelling both the Philadelphia & Reading and the Pennsylvania Schuylkill lines along the Schuylkill river to the anthracite fields. The statement is made, with some show of authority, that the Goulds have been purchasing the anthracite coal lands for some time and that both the Schuylkill Coal and Iron company and the Shankferoth Coal Company are acting in their interests. The report has caused more excitement in the Schuylkill basin, where there are many thousands of acres of undeveloped coal lands, most of which has been acquired by the two companies named during the past few months, although the identity of the officials of the companies is unknown.

Judge Rice, of the Superior Court, has declared unconstitutional that portion of the new child labor law which imposed an educational test upon boys working in the anthracite mines and breakers. The law was passed, at the last session of the legislature, at the request of the mine workers and increased the age limit for the mines from 13 to 16 years and the breaker from 12 to 14 years. Judge Rice held that the legislature had the right to impose a restriction as to age, inasmuch as it affected all classes, but it could not enforce an educational test as it discriminated against the boys who, while otherwise qualified, were unable to pass the examination required. It was also in violation of the Fourteenth amendment to the Constitution of the United States. Under this ruling, which will be accepted as final, the age limit will be raised, as mentioned, but the examination of the boys will be abandoned. A number of foremen have been fined for violating the clause which has been declared unconstitutional, and they will now make application for the return of the fines.

There is no growth in the strike sentiment in the anthracite region, and practically all the miners are hoping that there will be no cessation of work. There is a great calm, differing very materially from the stirring times preceding the conflicts of 1900 and 1902. National Organizer Matti, of the United Mine Workers, after a tour of the region, stated that while there were a number of grievances which the miners desired to have remedied, there was no expectation that there would be a strike and, personally, he believed that the miners did not want one. At the same time the various companies are not neglecting their preparations. The Philadelphia & Reading Company has been giving special attention to the pumps and hoisting plants in case work should be suspended on the first of April. Many parts of machinery are being renewed and sent out as soon as finished. A force of machinists is examining all the pump machinery throughout the system. The Primrose colliery, of the Lehigh Valley Company, near Mahanoy City, is being enclosed by an 8-ft. board fence, while similar precautions are being taken at the other collieries.

General Superintendent W. D. Zehnder, of the Lehigh Coal and Navigation Company, will resign on April 1, and will be succeeded by Baird Snyder, Jr., the present assistant general superintendent. Mr. Zehnder will be made consulting engineer of the company, with headquarters in Philadelphia. T. M. Whildin, the general mine foreman of the company, will resign on April 1 and will be succeeded by Thomas Jenkins, of Lansford.

A record was made on the main line of the Reading Railroad the other day when 1543 cars of coal were hauled. The next best run by the company was 200 cars less than this number. Another, and the final meeting of the Conciliation board, will be held in the last week of the month, when all the business undisposed of will be dealt with.

Two shafts are being sunk by the Philadelphia & Reading Company at John Veith colliery, and a new shaft is being sunk at the Otto colliery adjoining.

The new slope of the Lehigh Valley Company at Jeansville, which was flooded, has been pumped out and work resumed.

A peculiar fate is slowly overtaking the the borough of Gilberton in Schuylkill county. The valley is slowly subsiding and water is collecting, destroying the buildings and collieries. Already the Reading tracks have been elevated 18 ft. and attention had to be given them constantly. The water is creeping gradually higher. The town is being deserted and not a vestige of it will soon remain. The town is but little undermined but the mountain is honeycombed with slopes, shafts and tunnels.

After spending a large sum of money in extinguishing the fire in the Buck Mountain vein at Raven Run, the officials are much disconcerted to find that the fire has broken out again.

The Nanticoke dam on the Susquehanna river, which has been the cause of some disastrous floods, has been purchased by the Nanticoke Power Company, thus dissipating any hope of its being demolished.

An ejectment suit involving $200,000 has been commenced by D. J. Timony against M. S. Kemmerer & Co., who are mining coal on land in Foster township.

Toronto. March 15.

The spring influx of prospectors into the Cobalt mining area has already begun, favored by the extraordinary mildness of the season. Mining operations are going on steadily. The Jacobs mine has been shipping from 25 to 30 tons of ore per month to New York. One of these monthly shipments, made some time since, realized $57,000. Two veins have been located on this property, one being 4 in. and the other 2½ in. in width. The American mine has 90 men employed, working day and night shifts. Last week the company shipped to New York a ton of almost pure silver ore. The property of the Silver Leaf Mining Company, on which about $4000 had been expended for development, has been bought by an American company for $210,000.

The Gillies timber limit, immediately south of the Cobalt mining area, from which prospectors have been excluded, will very shortly be available for mining purposes, as the proprietors of the timber are clearing it as rapidly as possible. The

Gillies firm has 800 men employed in cutting and hauling timber and will in a few weeks have entirely cleared that portion of the limit which is known to be rich in silver ore. Preparations are being made for a big rush as soon the restrictions are removed.

The White Silver Company and Edward C. Hargrave, Frank N. Rutherford and Charles G. Williams, against whom the Ontario government recently brought a legal action to have their cobalt mining claims declared void, as having been fraudulently obtained, have brought a counter action against the Government, claiming $25,000 damages on the ground that they have expended $30,000 in developing the property, but were obstructed illegally by the Government in removing ore.

The experiments in electric smelting at Sault Ste. Marie terminated on the 5th inst., rather earlier than was expected. Dr. Eugene Haanel has returned to Ottawa and will make a report giving full details. He will confer with the Government as regards the advisability of undertaking further experiments on the same lines, as the appropriation made for the purpose has not yet been exhausted, and if his proposal is favorably considered, will shortly return to Sault Ste. Marie, accompanied by Dr. Heroult, to carry on the work.

The opening of the prospecting season in the Cobalt mining area is likely to be considerably delayed owing to a heavy snowstorm which occurred on the 3d inst. Snow fell to the depth of about one foot, which will make prospecting work impossible for some time yet. At the annual meeting of the Rothschild Cobalt Company, held at Haileybury, Ont., on the 27th ult., the immediate purchase of a boiler, engine and other equipments was authorized. The main shaft has been sunk to a depth of 57 ft. and development work has shown several silver-bearing veins. A rich strike of a vein of almost solid silver at the Savage mine is reported.

The Calgary (Alberta) Natural Gas Company will carry on operations vigorously during the present year and has sent a representative to Pittsburg to procure drilling machines for the work.

The Ashland Emery and Corundum Company, which operates the Burgess corundum mine in Carlow township, Hastings county, Ont., employing some 35 men, has six concentrators in operation separting iron and corundum from spar by the process of dry concentration, as employed in gold-reduction mills. The iron is then eliminated by a revolving magnet. The company has ordered $20,000 worth of new machinery from England, including Wilfley tables of the latest pattern, for concentrating ore, which will be installed this month.

At the Ideal gold mine, in Van Horne township, near Dryden, Ont., the rotary test mill is showing good values, which have lately been increased by the adoption of the roasting process before milling. The ore contains sulphur and the adoption of roasting to facilitate the extraction of the gold is a new experiment in the treatment of the ores of the district. The mine is operated by the Ideal Mining Company, of Detroit.

Sudbury, Ont. March 22.

The Sault rail mill turned out 15,000 tons during January, thus beating all previous records for a months' run. The entire output of the rail mill for several months has been sold and orders so far booked that the mill will run without a break night or day till October next.

A discovery of copper has been made in the township of Thompson in the district of Algoma, north of Dean Lake station. The property has been acquired by the Northern Ontario Copper Company and development work is proceeding thereon. A shaft has been sunk thereon to a depth of 15 ft., and the ore on the dump is high grade and said to be self fluxing and amenable to smelting, without any preliminary concentration.

All prospectors holding claims on the timber limit at Cobalt have been ordered off, and no further work will be allowed thereon. There is considerable speculation as to what the policy of the Government will be in the disposition of locations in the limit; some favor the idea of offering all claims at public auction, and while this would be the means of securing a large amount of revenue to the treasury, we must not lose sight of the fact that it has been made valuable by the development work of the prospector, who having spent time and money, should surely have some remuneration for his services.

The problem is an exceedingly hard one to deal with, and the principal difficulty thrust upon the department is the large number of claims recorded for every lot. In some cases there are as many as six applicants for one claim, and many have no right nor color to substantiate their claim. No doubt the inordinate greed of many so-called prospectors and schemers, has had much to do with the difficulties that now beset the Government in formulating a policy for the disposition of claims in the Gillies limit.

Victoria, B. C. March 18.

Managers and other representatives of smelters have again succeeded in inducing the Provincial Legislature to reject a proposed act to make an 8-hour day compulsory at all smelters in British Columbia. The proposed act, which it was intended should come into operation on March 1, 1907, if passed, was to the following effect: No person shall be employed in or about any smelter, sorting, hauling, removing or smelting ores or matte in any stage of preparation, for a longer period than eight hours in any twenty-four hours. Any owner, agent, or manager, or anyone acting on their behalf, employing any workman or person in contravention of this act, shall be liable to a penalty not exceeding $100 nor less than $20 for each workman or person so employed, and any workman or person so working for a longer period than specified in this act shall be liable to similar penalties. The socialist and labor members of the legislature made a most persistent fight, but a majority of the members of the House declined to make compulsory an 8-hour day when this concession had already been granted by the smelters of the province.

Work was commenced on February 27 on the excavations for the power house and engine room for the 1500-ton smelter the British Columbia Copper Company has arranged to erect at Greenwood in place of the smaller smelting works the company has been operating here since February, 1901. Some particulars of the machinery and plant ordered for the new smelter were printed in the JOURNAL of January 13. Recently contracts were let for excavations and masonry, respectively. There will be about 20,000 cu.yd. of excavations (including both earth and rock), and 2000 yd. of masonry in retaining walls, foundations, etc. Something like 1,200,000 ft. of timber will be required for ore bins, trestles, buildings, etc., and there will be about 1000 tons of machinery, plant, and structural steel. Construction and installation will be under the direction of the company's manager, J. E. McAllister, formerly with the Tennessee Copper Company at Copperhill, Tennessee, and it is expected that the new works will be in running order by September next.

The output of the Kootenay and Boundary mines for last week constitutes a record quantity, shipments having totaled 38,923 tons, making an aggregate for the year to date of 288,382 tons. Of this quantity 28,590 tons were produced by Boundary mines; 8580 tons by Rossland mines; and the remainder by mines in the Slocan and other parts of either East or West Kootenay. Ore receipts at the several smelters were: Granby (Boundary), 20,153 tons; Dominion Copper Company (Boundary), 5065; British Columbia Copper Company (Boundary), 3340; Canadian Smelting Works (Trail), 7775; Hall Mining and Smelting Company (Nelson), 1329; Sullivan Group Company (Marysville, East Kootenay) 500; and some small shipments to the Canadian Metal Company's works at Pilot Bay (Kootenay Lake), and Frank (Alberta).

Ore shipments for January and February total about 50,000 tons. Last week's shipments were: Canadian Consolidated Mines (Centre Star and War Eagle) 3780 tons; Le Roi, 3000 tons; Le Roi No. 2, 1500 tons, and Jumbo, 300 tons; total 8580 tons.

The directors of the Le Roi Mining Company on Feb. 28, paid a dividend of 1s. 6d. per share on its 200,000 £5 shares. This

is the first dividend this company has paid since November, 1899, when 5s. per share was paid. The aggregate of all dividends paid to date is $1,380,000. It is stated that the company's profits for January of this year were $39,000 and that February's profits were about a similar amount.

Ore shipments for last week were as follows: Granby Company's mines, 19,463 tons; Dominion Copper Company's mines, 4735 tons; B. C. Copper Company's mines, 3690 tons; Providence mine, 42 tons; total; 28,590 tons. The total for the year to date is 220,203 tons.

A record run for a single day was made one day last week at the Granby Company's smelter, Grand Forks, where 2850 tons of ore were treated in 24 hours.

Chicago men interested in several small high-grade mines near Greenwood are arranging a consolidation, to include the Helen, Preston, Strathmore and Barbara, all of which have been under development during the past year or two.

Mexico. March 17.

In Guanajuato nothing new has developed in the legal controversy between the Guanajuato Reduction and Mines Company and the Mexico Gold and Silver Recovery Company (holders of the patents on the McArthur-Forrest cyanide process in Mexico), though Ernest du Bois, representative of the latter company, says his company will protect its patents, while the former company continues its preparations for the doubling of its Bustos mill by the addition of 80 stamps, giving it a total of 180 stamps. In the meantime also the Guanajuato Consolidated Mining and Milling Company and the Peregrinas Mining and Milling Company continue with their extraction by the cyanide process unmolested. Of the railroad between Guanajuato, Marfil and Salamanca, projected by the Dwight-Furness Company, a considerable portion has been surveyed and the grading and construction work is being pushed with all possible speed.

In the State of Zacatecas continued report is current of various railroads to be built through the Sombrerete and Chalchihuites district, one of which is for a spur, or branch, of 100 miles, west from either the Fresnillo or Gutierrez station of the Mexican Central; another is the extension of the Mexican International from Durango to Guadalajara, passing near or through Chalchihuites and Sombrerete, the surveys for which were made over ten years ago; and still another is from the California Gulf coast, starting from either Guaymas or Topolobambo, through the State of Sinaloa and the districts mentioned, passing on to Guadalajara and possibly to the City of Mexico.

Considerable new life seems to be shown in the way of new boilers and hoist at the Nueva Era, of the Coahuila Mining and Smelting Company, a new steam hoist at the Candelaria, owned by Mexico City capital, and a cyanide plant for the Eureka, all of which properties are located in the Chalchihuites district, which needs only a railroad and the proper investment of comparatively small amounts of money to make an excellent and productive camp. Aside from large deposits of high-grade iron suitable for flux in lead smelting, and rich lead and silver deposits, it has some good copper veins which are well worth developing, and fine zinc outcroppings appear in a number of places, while tin has also been exploited in a small way near by.

At Sombrerete the lack of railroad facilities, necessitating a heavy haul of 80 miles over a very rough road, makes unprofitable the working of the large low-grade bodies of silver ore there at the prices prevailing for that metal of late years. The properties of the Sombrerete Mining and Milling Company, from which have been taken practically all of the high-grade ore that made an excellent showing for many years, are now scarcely paying expenses. This is but a sub-company of the Mexican Metallurgical Company, R. S. Towne, New York, president, whose numerous other properties around the Republic—at Santa Barbara, Chihuahua, at Sierra Mojada, Coahuila, at Monterey, Nueva Leon, at Concepcion del Oro, Zacatecas, and at San Luis Potosi, as well as the smelter at the latter point—do not seem to have been giving the returns of former years. The company has been forced to pass its last quarterly dividend. At Santa Rita, in the Nieves district of Zacatecas, it is expected the 50-ton smelter will soon be blown in. At Concepcion del Oro, Zacatecas, the Mazapil Copper Company is planning to tunnel from its smelter through to the Aranzas mines to replace the cable tram, which has not given the capacity required. It is expected that this company's new smelter, which is in course of construction at Saltillo, will be ready to blow-in in the early fall, giving the company a much larger smelting capacity.

Guanajuato, Mexico. March 19.

The experimental plant of the Guanajuato Reduction and Mines Company was closed down last week by the MacArthur-Forrest people, who came up in force from Mexico City with their entire contingent of officers and lawyers with the apparent purpose of overawing and crushing out any disposition to overlook the rights of the MacArthur-Forrest Company. It is well known that the MacArthur-Forrest Company has heretofore neglected to fully assert its rights in the Mexican Republic, fearing that it might arouse an organized opposition which would result in the breaking of its patents, as occurred in South Africa when a test case was fought out. The policy of the Cyanide Company in Mexico has generally been to wait until the mill has commenced operations and then make its demand for royalties, settling in some cases for ridiculously small figures rather than to run the chances of a court decision. Lately, however, the Cyanide Company has been strengthened by the addition of several influential individuals to its ranks, and is now proceeding most strenuously to assert the rights conveyed by its Mexican patent to collect royalty.

No warning was given the Reduction and Mines Company, the first intimation being a descent upon the mill by the Cyanide Company in the person of its president, Lic. J. L. Requeña, and vice-president, Lic. I. S. Gavito, Jr., prominent attorneys of Mexico City. These gentlemen, accompanied by one of the local criminal judges, went to the milling plant, took testimony, and caused the arrest of the American engineer in charge of the operations and had him placed in jail. This high-handed proceeding has aroused universal indignation among mining men throughout the district, and will no doubt result in the organization of a force to overthrow the unjust demands of a company which bases its claims on patents which in other countries have been found untenable. The lack of organization of the mining interests in the Republic is sadly apparent in this as well as in the case of the Dynamite Company, which seems in no hurry to rebuild its factory, as long as it is able to make about $200 per carload on the dynamite it imports at present from the United States through the concession granted it by the Mexican Government, which gives it the monopoly to manufacture and import dynamite for the entire Republic.

London. March 10.

In recent letters I have referred to the gold mines in the Kolar district of India, and mentioned specifically the falling off in the production at Champion Reef and the continued ill fortune at Coromandel. This week details of the work during 1905 at the Mysore Gold Mining Company, the pioneer in this district, are at hand. This mine continues to be extremely prosperous, and the developments at depth are as satisfactory as at any time during the twenty years' history of the mine. In order to cope with the hauling from the 3000 level and also to provide further shaft accommodation, it has been decided to spend £180,000. As is the usual practice with John Taylor & Sons, this expenditure is not being met out of revenue, but by the issue of new stock, and 30,000 new shares are to be offered at £6 each to the shareholders, that is at a premium of £5 10s., the nominal value of the shares in the company being 10s. During the last few years we have heard a good deal about payment of all expenses out of revenue and in many quarters the creation of new capital for the provision of extensions of plant and new shafts is depre-

cated. John Taylor & Sons have always adhered to the old plan of issuing new capital for the purpose of extending operations. Their system is endorsed by professional accountants, and by the income tax assessors. It has the advantage of not interfering with the payment of dividends and with the Stock Exchange quotations of the shares, and also that only those shareholders who agree with the policy of extension need provide the capital. In the present case £420,000 is being distributed as dividends for 1905, and such shareholders as are included are asked to provide £180.000 out of it for increased capital expenditure. The nominal capital of the company will be increased from 580,000 shares of 10s. each to 610,000 shares of the same par value. This nominal capital of the company is of course far less than the actual sum expended on capital account, for all the various issues of new capital have been made at high premiums. The rate of distribution of dividend mentioned above is the same as a year ago. During the past year 195,650 tons of quartz were milled, yielding 184.957 oz. of bar gold, and 20,432 oz. were produced by cyanide, giving a total gold yield of 205,389 oz. of bar gold, equal to 207,049 oz. of standard gold. John Taylor & Sons are essentially a British institution, so they use British standard gold in their reports, but it would be more convenient for purposes of comparison with mines in other countries if they used fine ounces instead. During the year the ore reserves have been increased from 523,000 tons to 613,000 tons.

The shares of a Melbourne company called the Hampden-Cloncurry Copper Mines, Ltd., are being introduced on the London market. This company is one of considerable promise, and is backed by the Broken Hill, Mt. Lyell and Zinc Corporation people, Bewick Moreing & Co., and others. It has among its directors W. Knox, H. H. Schlapp, H. J. Daly and W. J. Loring. The company has been formed to acquire the Hampden copper mines in North Queensland. These deposits have been known for many years, but owing to absence of railway communication nothing could be done with them. The Queensland Government has now decided on building a railway which will come within 47 miles, and the company is arranging for the building of methods of communication over the remaining distance. A. S. Low and A. E. Savage have reported on the property, but the details are not yet at hand. The deposits can be worked by open cut, and there are large bodies of oxidized ores. The sulphide ores below have not yet been explored.

Rhodesia gold gains. For the two months ending Feb. 28 the total was 80,987 oz. bullion, which compares with 62,662 oz. in the corresponding period last year; showing an increase of 18,325 oz., or 29.2 per cent.

General Mining News.

Petroleum Exports—Exports of mineral ores from the United States for the two months ending Feb. 28 were as follows, in gallons:

	1905.	1906.
Crude petroleum	11,398,227	21,395,294
Naphthas	4,771,738	6,155,740
Illuminating oils	107,753,787	112,745,257
Lubricating oils	14,565,697	31,191,209
Residuum	8,617,266	9,669,925
Total	147,106,715	181,157,425

Paraffin is included in lubricating oils, The total exports this year show an increase of 34,050,710 gallons, or 23.1 per cent.

CALIFORNIA.

AMADOR COUNTY.

Bunker Hill Mining Company—The explorations in the lower levels of this mine have resulted in the uncovering of good rock. The orebodies in sight warrant the addition of 20 stamps to the 20-stamp mill now at the mine, and this will shortly be made.

ALPINE COUNTY.

Hercules Mining Company—These mines at Loope, owned mainly by Capt. Peter Curtz, with the mill, water rights, power sites, etc., have been sold to the Humphrey Bros., R. Kirman and W. H. Moffitt, of Reno, Nevada, for a published price of $100,000. An electrical power plant will be put in at once.

CALAVERAS COUNTY.

Penn Chemical Works—A railroad is to be built immediately from a point on the Southern Pacific line between Burson and Valley Spring to the copper mine and reduction works of this company at Campo Seco. Some very extensive improvements will be made on this property on the completion of the branch railroad.

Voinich Mining Company—Half of the stamps of the new 40-stamp mill of this company at Angels have been started up, and the rest will be, as soon as the ditch is repaired to give sufficient water power. The mine shaft is now down 700 ft. and $6.50 rock is being taken out of four levels, including the lowest one.

EL DORADO COUNTY.

Alverstone—In this copper mine, Placerville district, the ledge has been struck in the tunnel at 117 ft. A contract has been let to run a drift 100 ft. south.

Alcimento—The new roller mill at this mine, Smith Flat, has been started up and works satisfactorily.

Alveoro—At this time, Smith Flat, the buildings have been completed ready for new machinery. A roller mill is to be installed.

MENDOCINO COUNTY.

Manganese—It is reported that the manganese deposits in Redwood mountain have been bonded to Eastern men, who will develop them at once. The ore is to be hauled to Redwood, west of Potter Valley, and thence shipped East. These deposits have generally been understood to be of low grade and how such ore can be shipped East at a profit remains to be seen.

PLACER COUNTY.

Paterson—This mine, north of Penryn, owned by J. B. Paterson, is being put in order for extensive work. Part of the ground can be worked by dredge or by hydraulic process. The material now being mined mills about $6 per ton, and the mill in use crushes about 150 tons per day.

PLUMAS COUNTY.

Dr. Newbold, of Oroville, has bonded all the property in Lone Rock valley, about 15 miles northeast of Indian valley, near the Lassen county line, for dredging purposes, and will prospect it with drills as soon as weather permits work.

SAN BERNARDINO COUNTY.

Gold Peak Mining Company—At this property, 18 miles from Dale, owned by Los Angeles men, a 500-ft. shaft is being sunk on one of the 54 claims owned by the company.

Brooklyn Mining Company—This company, at Dale, has ordered in San Francisco a mill of 25 tons daily capacity.

SHASTA COUNTY.

Uncle Sam Mining Company—This gold quartz mine at Kennett, which has resumed work within the past year under supervision of James W. Neill, is just at present shipping large quantities of sulphurets to the Selby Smelting Company.

SISKIYOU COUNTY.

Ault & King—This quartz prospect at the head of Six Mile creek has been bonded to W. H. Young and M. Janse. Another 100 ft. on the main working tunnel are being run, and another lower tunnel is to be started.

New York—The mine on Indian creek, J. B. Scott, superintendent, which was closed down about a year since, will resume operations shortly.

Blue Ledge—About 60 men are now at work on this copper property on Siskiyou mountain, near the Oregon line.

SAN LUIS OBISPO COUNTY.

Little Bonanza Quicksilver Mining Company—This company, at Klau, which recently purchased the Karl quicksilver mine and also owns others, is about to sink a new shaft. H. E. Pearson is manager.

TULARE COUNTY.

Powell Copper Mine—This property has been purchased by K. Barrett, H. J. Mueller and others. Supplies are being sent to the mine and extensive development work commenced.

TRINITY COUNTY.

Mason & Thayer Company—J. C. Mason and S. J. Thayer have deeded to this

new company all interest in their claims on Cañon creek. A lower tunnel is to run on the mine, and as soon as the necessary development work is done, a stamp mill and all necessary appliances will be installed.

Union Hill Mining Company—This company now holds a bond on the Paulsen-Union Hill properties between Lowden Ranch and Douglas City, with Mark Manly as general manager. It is the intention of the company to fully equip this hydraulic mine and construction work will commence as soon as the weather permits.

Big Creek Placer Mining Company—This company, operating on Big creek, near Hayford, James Hesslewood manager, will soon set men at work completing six miles of ditch. Considerable placer ground in that vicinity will soon be equipped.

COLORADO.

BOULDER COUNTY.

Victoria—This mine, located in Gold Hill district, is reported sold for a consideration of $125,000 by L. W. Foule, of Boston, to Cripple Creek people. Property is being worked largely on leasing system, and John Connors, Gold Hill, Colo., is the new manager.

Tungsten Find—Manning & Co. have opened some good tungsten ore on the Harrington lease on the Barker patent at Nederland. They are getting out a large shipment.

GILPIN COUNTY.

Gettysburg Mining and Milling Company—Arrangements are being made to resume operations on this group in Lump gulch by Walton, N. Y., owners. They have also leased the Victoria mill and will install a dry-process plant for the treatment of their ores. A. M. Willard, Gilpin, Colo., is manager.

Amazon Group—This group, consisting of 10 lode claims situated in Wisconsin district, has been sold by Bramlett Bros. to the Amazon Company for a consideration of $20,000 in all.

Gunnell Gold Mining and Milling Company—An early reorganization of the interests of this company is expected. New pumping and other machinery will be installed and a large amount of deep development work will be carried on. Frank C. Young, Central City, Colo., or 117 Boston building, Denver, is manager.

A. A. Johnson Mining and Leasing Company—This company has filed articles of incorporation, with $100,000 capital stock, and has taken a lease and bond on the Pendleton in Russell district. J. R. Woods, Russell Gulch, Colo., is superintendent.

OURAY COUNTY.

Camp Bird—A mammoth snowslide in the Mount Sneffels region, six miles south of Ouray, on March 17, razed the Camp Bird mine house, boarding house and reading room. William Cressey, a miner, was killed, and it is feared that other lives were lost. A number of men, it is reported, were seriously injured. The property loss is estimated at $400,000. The Camp Bird bunkhouse, containing 200 men, narrowly escaped destruction. The residence of General Manger Cox also barely escaped destruction. The slide had largely spent its force before reaching the assay shops and general offices of the Camp Bird mine.

For a whole week it had been storming almost continuously. There has not been a train run between Telluride and Durango for a week, and the road is still blocked by snowslides near Ophir and Rio.

SUMMIT COUNTY.

Several important mining deals are being consummated or are on tapis for early closing. T. W. Breene has disposed of his large tract of mineral ground in Kokonco to a Milwaukee company for $500,000. The purchasers intend to build a modern mill of large capacity to treat the ore which occurs in large bodies. Another Summit county deal of importance is the purchase of the controlling interest of the Wire Patch property by Mark G. Evans and associates. This property is world-famed as the producer of the magnificent crystalline gold specimens which have taken first prize against the world wherever shown. The property is situated on Farncomb hill, 4 miles north of Breckenridge.

A strong company is at present endeavoring to secure the Minnie mine and mill on Mineral hill 2 miles north of Breckenridge. The leasers now working it are taking out good shipping ore, and are at the same time piling up a good grade of mill dirt for treatment in their concentrating mill when the spring opens.

The main ledge of the Country Boy mine has now been followed 350 ft. by drift, and it continues to improve. The breast of the drift is now beyond the old workings above, and the ledge is 4 ft. wide, 18 in. of it assaying 53 per cent. zinc. The Sallie Barber mine, on the north slope of Bald mountain, is being worked by Leadville and Cañon City capitalists. The vein in the bottom of the shaft is now over 4 ft. wide and carries high-grade zinc. Drifting on this has been started. A new main shaft will be sunk vertically in a new place to cut this ledge at depth. Two car-loads of high-grade zinc have just been shipped to Cañon City.

A good strike has just been made in the East drift from the Dean shaft on the Silver King property. In drifting in this direction, a new vein was cut, which showed up large bunches of lead sulphide, as well as "hard carbonates;" both of which ores are rich in gold and silver values.

The Jessie mine is opening up well, and Manager Hogan is getting the mill put into shape to start milling early in the spring.

The Wellington mine is shipping regularly, and piling up mill ore right along. Of this latter they now have over 10,000 tons in the dump.

The Gold Dust is getting out another large shipment of high-grade ore.

The Morning Star is doing development work and blocking out ore ready to make regular shipments in the spring.

The Atlantic mine is shipping 15 tons per day from North Star Mountain, and if more teams were available they could increase the output to 30 tons per day.

George Horne brought in some good bulk samples from the Edna & Leona properties, and obtained assays up as high as 10 ounces of gold per ton, besides good silver values.

MARYLAND.

The report of the Cumberland & Pennsylvania Railroad gives the total coal mined in the Cumberland region in 1905 at 6,226,284 tons. Of the amount mined last year 2,096,213 tons were produced by the Consolidated Coal Company; 1,370,356 tons by the Davis Coal and Coke Company; 787,829 tons by the Black-Sheridan-Wilson Company; 244,684 tons by the Maryland Coal Company; 231,581 tons by the George's Creek Coal and Iron Company; 224,423 tons by the Piedmont & George's Creek Coal Company; 218,544 tons by the American Coal Company; 119,689 tons by the New Central Coal Company; 143,900 tons by the Cumberland Coal Company (Douglas mine), and the balance by the other companies operating in this and the Potomac Basin. In round numbers 4,197,440 tons were mined in the George's Creek region, and 2,028,844 tons were mined in the Upper Potomac Basin. The disposition of the coal mined was as follows:

Shipped by Balt. & Ohio R. R.	4,309,071
" " Penna. R. R.	938,679
" " Ches. & Ohio Canal	163,847
Local consumption and at mines	814,687
Total	6,226,284

The Baltimore & Ohio Railroad carried about 70 per cent of the coal mined.

MICHIGAN.

HOUGHTON COUNTY—COPPER.

Atlantic—The Baltic amygdaloid bed has not yet been encountered in the crosscut on section 16, as reported. Crosscutting west from the drift has been discontinued and a crosscut has been started eastward. The explorations are being carried forward through a drift which was extended north 600 ft. into section 16 from No. 5 shaft of the Baltic mine at the sixth level.

Erie-Ontario—Sinking in the shaft on this property has been resumed. It will be continued for 200 to 300 ft. To date

425 ft. of development work has been done, of which 340 ft. is in crosscutting and 112 ft. in sinking. Work at the first level, where operations were discontinued, revealed a promising formation, but there was not much copper.

King Philip—The shaft sinking on this property, south of the Winona, will enter solid rock at a depth of 100 ft., as the ledge was located at that depth by a sandpipe driven from the bottom of the shaft after it had attained a depth of 30 ft.

Superior—Sinking in the shaft on this property was suspended recently at the third level. Crosscutting to reach the lode at that depth is now under way.

Tamarack—Work in No. 5 shaft has been resumed after an extended idleness caused by the fire in No. 2 shaft. Drifts connecting No. 5 with No. 2 at the 29th and 31st levels were blocked up to prevent the deadly gas in the latter endangering the men. With No. 5 shipping rock, the production will be restored nearly to normal proportions, as No. 3 is making a large output.

NEVADA.

WHITE PINE COUNTY.

The Nevada Consolidated Copper Company, whose new 1000-ton concentrator equipment is being built by the Allis-Chalmers Company, Milwaukee, has purchased additional electrical equipment for the plant recently, in the shape of eight 200-kw. oil-filled water cooled transformers, with 20,000 volts secondary. They will be installed in connection with the other electrical machinery already on order.

OREGON.

BAKER COUNTY.

Goose Creek—C. C. Cox, managing owner of the Goose Creek group of copper claims, lying to the southeast of Baker City, about 30 miles, and which are situated on the main copper ledge, extending from Snake river, at Homestead, northwesterly into Union county, is beseiged with applications from capitalists and prospectors in the East anxious to enter the new camp. That there will be a stampede into this copper belt this season, is a certainty, and with it is the assurance of investment of capital for the development of properties already opened.

United Elkhorn—A tremendous blizzard in the mountains kept the United Elkhorn mines snow-bound for three days, but the roads were finally broken through by heavy teams, and 50 men, and the shipments of concentrates has been resumed. Manager Edward I. Field is still taking out the ore from the lower levels. His new electric machinery and air compressors are working satisfactorily.

SOUTH DAKOTA.

PENNINGTON COUNTY.

Clara Belle Mining Company—A correspondent informs us that C. O. Bartlett, of Cleveland, Ohio, has taken up the option on this company's property at Oreville, and the control passes to him and his associates. About $30,000 has been spent on this property during the last nine months in building new houses, putting in a sawmill, a new shaft house, new 10-stamp mill, putting in a compressor and drills, boilers and engines, sinking the shaft, driving tunnels, etc.

Samples of ore were sent to Fueller, of Denver, and running tests were made on the ore taken at a depth of 250 ft., which yielded $44 per ton; 75 per cent. of which was saved on the plates and the balance up to 94 per cent. by cyanide.

This is the plan adopted in building the new mill: The small two-stamp mill has been running since October and will continue to run until the new 10-stamp mill is finished, about May 1. The small mill is turning out over $100 a day from the plates. The tailings are being stored for future treatment in the new mill. A new shaft will be sunk at once to tap the orebody at a depth of 500 ft. At a depth of 250 ft. the vein was 27 ft. wide and from 3 to 5 ft. thick. At a depth of 300 ft. it had increased over 100 ft. in width and was from 4 to 8 ft. thick and richer in free gold. This property consists of about 200 acres and is 1½ miles from Oreville, with plenty of good timber and water.

UTAH.

JUAB COUNTY.

Mammoth Mining Company—R. M. Wilkinson, secretary of this company, writes us as follows, under date of March 14: "Please correct the statement in your issue March 10 in reference to the Mammoth Mining Company. It is misleading to our many stockholders throughout the United States and Europe, to whom a circular letter and blank proxy have been sent. Our 25-year charter ran out last month; we are at present incorporated under the laws of Utah (having had it extended until we could incorporate in another State, Nevada), at a capitalization of $10,000,000 divided into 400,000 shares at a par value of $25 each. In the new incorporation it is proposed to capitalize at $1,000,000 divided into 400,000 shares at a par value of $2.50 each." The circular contains notice of a stockholders' meeting, to be held in Salt Lake City, March 31, for the purpose of voting on the re-incorporation of the company.

WASHINGTON.

FERRY COUNTY.

Pearl Consolidated—Work is being pushed on the 190-ft. level. The main drift northeastward is going ahead, and an upraise and a winze have been started on ore. The second-class ore from the lower dump has all been shipped to the smelter.

Ben Hur—Ore is being shipped to the smelters as fast as it can be used at Greenwood and Trail, B. C.

Quilp—Work has been resumed on the 400-ft. level. The shipments from the mine average a carload a day.

Copper Key—Development is being pushed with increasing activity. Ore has been encountered on the footwall in an upraise 200 ft. above No. 2 tunnel level, above an intrusion on the vein of trachyte. The upraise, 4x6 ft. in the clear, is all in ore carrying gold, small value in silver and a little copper. This ore is sulphide with a large excess of iron, and just now in demand at the smelters. Four extra miners have been employed, and more will be put on as fast as room can be made for them to work to advantage.

Frisco Fraction—This is situated on Iron mountain, about 8 miles eastward from Republic, and owned by the Richey Mining and Developing Company, of Pullman, Wash. A vein 8 ft. wide is reported to carry 6 per cent. copper, with some silver and gold. A tunnel, in 17 ft., will be extended 50 ft. further on contract, and will have 110 ft. to run to strike the vein 120 ft. below the outcrop.

OKANOGAN COUNTY.

Phil Sheridan—The south drift on No. 1 tunnel level has run into a new payshoot of ore as good as any yet found in the mine, and the body is widening and appears to be gaining strength as it gains depth in the hill. The old stope has now a hight of 30 ft. above the tunnel level. About 7 tons of ore have been hauled to Lynch's siding since the last shipment to the smelter, and 12 tons more have been sacked at the mine, ready to haul as soon as the roads will permit.

Stemwinder—An open cut in a new place has developed ore to a depth of over 20 ft., 75 ft. from the Kismet claim of the Phil Sheridan group, and the ore is identical with that of the Phil Sheridan vein. Apparently the two veins run almost parallel with each other. The Stemwinder ore is the richer of the two in gold.

Grand View—The electric power plant on Cecile creek has been set in operation for motive purposes, to try the effectiveness of the machinery at the company's mill at the head of Palmer lake. The mill was illuminated with electric lights, and the machinery was started in motion and worked satisfactorily. The Riblet aerial tramway having been completed and the ore from the upper terminal lines conveyed to the storage bins at the mill, the rock crusher was set in motion and the inner bins at the mill filled, to await orders for dropping stamps and permanent running of the mill. Everything so far has worked smoothly. The stamps will begin dropping on ore as soon as the reserve is sufficient to keep the mill in motion.

Foreign Mining News.

CANADA.

BRITISH COLUMBIA.

Tyee Copper Company—This company reports that during February its smelter at Duncans Station, Vancouver Island, ran 13 days and treated 2224 tons of Tyee ore, giving a return, after deduction of freight and refining charges, of $34,402; an average of $15.02 per ton.

NEW GUINEA.

E. A. Duncan, who has been prominently connected with gold-mining operations in New Guinea for some years, states that he has lately been mining on the Aicora river, in the northern territory of New Guinea, but owing to wet weather mining is now rather quiet, though there is a fair amount of gold being got at present. Aicora workings appear best, but there, as everywhere, miners have a lot to contend against in procuring laborers. Attention is now being given to gold dredging, and it is believed that the prospects on the Tomato river are suitable for this method of mining.

Coal Trade Review.

NEW YORK, March 21.

The coal markets, East and West, are dependent entirely on the controversies between miners and operators. The outlook is still uncertain and it seems quite probable, as April 1 approaches, that there will be at least a temporary stoppage of mining.

The bituminous conference re-convened this week at Indianapolis. Preliminary meetings of the Indiana and Illinois operators showed apparent majorities against any concessions. Ohio is inclined to be neutral, while the Pittsburg district favors a settlement. Up to date the conference has done nothing beyond a formal resolution to disagree and the appointment of a joint committee on wage scales. While local opinions differ as to the prospect, it looks as if an agreement might be reached on the basis of the 1903 scale; that is, an increase of 5.5 per cent. over the wages of 1904-1905. Minor points may complicate the settlement.

In answer to Mr. Mitchell's request for a further conference, the anthracite operators have announced their willingness, to go into another meeting. At the same time, however, they state that their letter —published last week—gives their final terms, and intimate that these will not be changed. Reports from the anthracite country are that the miners generally are not in favor of a strike.

Reports are current, apparently on good authority, that if no settlement is reached, President Roosevelt will reconvene the Anthracite Strike Commission of two years ago. This seems quite probable.

COAL TRAFFIC NOTES.

The total coal and coke traffic originating on all lines of the Pennsylvania railroad east of Pittsburg and Erie for the year to March 10, was as follows, in short tons:

	1905.	1906.	Changes.
Anthracite	762,529	978,013	I. 215,484
Bituminous	4,964,116	7,122,784	I. 2,158,668
Coke	1,949,946	2,408,737	I. 458,791
Total	7,676,591	10,509,534	I. 2,832,943

Shipments of coal from the Broad Top region in Pennsylvania for the week ending March 17 were 21,463 tons; for the year to March 17 they were 232,618 tons.

Shipments of anthracite coal in February were 4,712,099 tons, an increase of 789,498 tons, or 20.1 per cent., over February of last year. For the two months ending Feb. 28 shipments were:

	1905. Tons.	Per Ct.	1906. Tons.	Per Ct.
Reading	1,638,666	19.7	2,125,732	20.9
Lehigh Vy	1,328,936	16.0	1,513,112	14.9
N. J. Central	1,127,239	13.5	1,344,828	13.2
Lackawanna	1,405,379	16.9	1,620,588	15.9
Del. & Hudson	807,908	9.7	1,009,017	9.9
Pennsylvania	695,943	8.3	887,645	8.7
Erie	717,993	8.6	974,341	9.6
N. Y., Ont. & W.	389,218	4.7	423,141	4.2
Del., Sus. & Schu'l	219,897	2.6	271,779	2.7
Total	8,331,179	100.0	10,170,183	100.0

The total increase this year was 1,839,004 tons, or 22.1 per cent.

The Chesapeake & Ohio Railway reports coal and coke tonnage, for the seven months of its fiscal year from July 1 to Jan. 31, as follows, in short tons:

	Coal.	Coke.	Total.
New River	3,154,766	188,830	3,343,596
Kanawha	1,610,652	68,481	1,679,133
Kentucky	60,406	.....	60,406
Connecting lines	260,143	21,068	281,211
Total	5,085,967	278,379	5,364,346

The totals show increases of 599,717 tons of coal and 123,208 tons of coke over last year. The disposition of the tonnage originating on the line was: To points west, 2,034,532 tons coal and 146,677 tons coke; to ponts east, 851,975 tons coal and 110,634 tons coke; to tide water 1,939,317 tons coal.

New York. March 21.

ANTHRACITE.

The hard-coal market is in a dubious condition, owing to the apparent hopelessness of any agreement between miners and operators. The miners have asked the operators to give them another conference, but since the operators have already refused the miners' demands, a second meeting would probably result in nothing. Consumers are carefully stocking up as much coal as they can, and a strong demand exists for coal of all kinds. The local dealers have taken advantage of this by raising their prices 50c. per ton. Nothing has yet been decided as to whether or not the customary 50c. reduction will take place on April 1; as long as the strike remains in suspense, no reduction will probably be announced, and if a strike is determined upon, certainly no reduction will occur.

Prices hold at $4.75 for broken and $5 for domestic sizes. Steam sizes: $3 for pea; $2.25@2.50 for buckwheat; $1.45@1.50 for rice and $1.30@1.35 for barley f.o.b. New York harbor shipping points.

BITUMINOUS.

The Atlantic seaboard soft-coal trade is in a strong condition; demand is general for all the coal coming forward, and except in New York, prices are strong. Insufficient car supply is curtailing production. The taking of contracts goes forward slowly, as producers do not like to commit themselves in the present unsettled circumstances. The labor question does not excite as much interest along the eastern coast as it has in previous years. The general sentiment is that wages are as high as are warranted by the facts, and producers do not favor the paying of more.

Trade in the far East is good; demand is strong, and consumers are willing to pay advances for the sake of prompt shipments. The Sound is actively demanding more coal than can be supplied. New York harbor is absorbing all the coal arriving, but prices remain stationary; coal at the shipping ports is apparently being used for speculative purposes.

All-rail trade shows a strong demand at high prices. Car supply is poor on all roads but the Pennsylvania, which is supplying about three-fourths of requirements. Transportation is generally good.

Vessels in the coastwise market are in fair supply, but demand is strong and rates are well maintained. The lower ports are charging $1 to Boston, Salem and Portland, and 80@85c. to the Sound.

Birmingham. March 21.

The coal production in Alabama shows no change, and there is a demand for every ton of coal that can be mined. The railroads are being asked to keep up a full supply of cars.

The Sloss-Sheffield Steel and Iron Company expects shortly to be getting a big supply of coal from its new Bessie mines, in the western part of Jefferson county. The Tennessee Coal, Iron and Railroad Company announces a steady improvement in the coal production in the Pratt Mines division, where the strike of the union coal miners during the last nineteen months has been felt most. Last Thursday the production in the Pratt Mine division went to 6500 tons.

The visit of John A. Topping, president of the Republic Iron and Steel Company, to Birmingham district, is taken to mean much for this district. Mr. Topping left here for Florida, but announced before leaving that he would return toward the latter part of the month, when John W. Gates and other directiors in the Republic and Tennessee companies would be in Birmingham to look over the properties of the two companies and hold a meeting in this city to take steps looking to

the future joint management of affairs.

The coke production is holding up well. There is a good demand for the product and steady prices prevail.

Chicago. March 19.

The coal market has become in a large measure speculative, in view of the prospects of a strike at the mines. Prices on Illinois and Indiana coals are high, and the cold weather of the last week has brought every grade of coal, steam and domestic, into active demand. In consequence of these two forces, the market is a strong and advancing one, that will continue to record heavy sales at high prices, unless there is unexpected news that a strike is improbable.

Lump and egg from mines of Illinois and Indiana brings $3@3.25; run-of-mine has risen to $2.35@2.90, and screenings are particularly strong, being sold at $2.20@2.40. Railroads, retailers, and to some extent consumers, are stocking their bins against the threatened scarcity.

Hocking, smokeless and other eastern coals are not so much affected, but sales of all are reported better than for several weeks. Hocking is active at $3.40; smokeless in in good demand but somewhat scant supply, with run-of-mine strong at $3.15. Lump and egg have been brought somewhat into demand again by the cold weather, and bring $3.55. Youghiogheny is in better demand owing to the uncertainty about contracts, three-quarter bringing $3.25.

Anthracite has been somewhat active, due both to apprehension of a strike and the unusually cold weather, which has quickly emptied the small supplies of householders and retailers, bought to piece out needs until the April discounts are effective. No great increase in buying, however, is probable until April 1, notwithstanding the course of labor matters, for the general prosperity inclines consumers to take their chance of being able to obtain coal when they need it.

Cleveland. March 22.

The coal situation has been complicated by the prospect of a lake strike, coming upon the continued prospect of a strike in the coal mines. The latter had caused rush buying of coal in large quantities. All consumers, including the railroads, have been buying in excess of current needs and have been paying premium prices. Lake shippers, anticipating a tie-up at the mines about April 1, have been trying to get a few cargoes in boats at Lake Erie ports ready to move to the head of the lakes when the channels are free of ice. The railroads were somewhat hard put to find cars and engines to haul all of the coal demanded, but managed to make shift with the slightly easier conditions in the general line of trade. Now that the lake season of navigation seems to be threatened by a strike of the longshoremen, in aid of the masters and pilots, it is not a matter of such urgency to get lake coal to the docks and that part of the demand has eased. But the current buying of coal is too strong to permit any such influence to have much weight in the market. The best grades of run-of-mine steam coal have been selling at $1.25 at the mines with slack bringing $1 at the mines, in both Ohio and Pennsylvania. The slack supply promised to be easier with the shipment of lake three-quarter coal, but the stoppage of this movement limited the supply of slack.

Coke is still strong, with the apparent buying of consumers in excess of needs for storage purposes and the market has been firm. The best grades of 72-hour foundry coke have been selling at $3 to $3.25 at the oven and the best grades of furnace coke have sold at $2.40 to $2.60 at the oven. The demand for domestic coal has been a little heavier with the appearance of cold weather.

Pittsburg. March 20.

Coal—All the mines in the Pittsburg district are being operated and the production is unusually heavy. On old contracts prices remain on a basis of $1@1.10 for mine-run coal, consumers in most instances being permitted to increase the original orders; but on strictly new business premiums in various amounts are asked. The steel companies are storing large quantities and a large tonnage is being held on the river, as a strike is expected. For the first time on record, with many barges and boats loaded in the pools and harbor and the rivers navigable, no coal was sent to the lower markets. The joint conference of bituminous coal operators and miners is being held in Indianapolis and a final effort is being made to avert a strike for an increase in the mining rate. It is now regarded as certain that the Pittsburg Coal Company will concede the 1903 scale, which means an advance of about 6 per cent., but the independent operators in the district are opposing any advance. Leading producers in Illinois, Indiana and Ohio also have declared against a compromise. As a result of the attitude of the other operators, parties to the interstate agreement, Chairman Francis L. Robbins, of the Pittsburg Coal Company, has resigned the leadership of the operators and will represent his company only in the conference. J. H. Winder, of Cleveland, was chosen leader in his place. For several days the railroads have been confiscating coal along the lines as a matter of precaution.

Connellsville Coke—Production fell off slightly but there was an increase in shipments compared to the prevous week. Prices remain unchanged, furnace coke being quoted at $2.35@2.50 and foundry at $2.90@3 a ton. The production for the week amounted to 279,953 tons, a decrease of 550 tons. The shipments aggregated 12,176 cars distributed as follows: To Pittsburg and river points, 4406 cars; to points west of Pittsburg, 6506 cars; to points east of Everson 1264 cars. This was a gain of 295 cars. The total shipments from the Connellsville and Masontown fields amounted to 353,552 tons.

San Francisco. March 15.

No change can be reported in the fuel market. Arrivals of coal have been better, and stocks are sufficient.

Prices are steady. For coast coals, in large lots to dealers, prices are as follows: Wellington, New Wellington and Richmond, $8; Roslyn, $7; Seattle and Bryant, $6.50; Beaver Hill and Coos Bay, $5.50; White Ash, $5.25. For Rocky Mountain coals in car lots quotations are: Colorado anthracite, $14; Castle Gate, Clear Creek, Rock Springs and Sunny Side, $8.50. Eastern coals are nominal at $14 for Pennsylvania anthracite and $13 for Cumberland. For foreign coal quotations are, ex-ship: Welsh anthracite, $13; cannel, $8.50; Wallsend and Brymbo, $7.50 per ton.

Foreign Coal Trade.

March 21.

Imports of coal into Germany in January are reported as below, in metric tons:

	1905.	1906.	Changes.
Coal	583,089	636,214	I. 53,125
Brown coal	680,153	693,447	I. 13,294
Coke	65,534	60,209	D. 5,325
Total	1,328,776	1,389,870	I. 61,094

The more important imports of coal were from Great Britain. The brown coal, or lignite, was all from Austria.

Exports of fuel from Germany in January were as follows. in metric tons:

	1905.	1906.	Changes.
Coal	1,322,584	1,837,899	I. 515,315
Brown coal	1,367	1,372	I. 5
Coke	200,827	280,856	I. 80,029
Total	1,524,778	2,120,127	I. 595,349

The larger exports of coal were to Austria, Holland and Switzerland; of coke to France. Included in the exports this year were 1130 tons of coke to the United States.

Revista Minera reports the production of coal and coke in Spain for the past two years, as follows, in metric tons:

	1904.	1905.	Changes.
Anthracite	165,008	159,372	D. 5,636
Bituminous	2,707,629	2,885,711	I. 178,082
Lignite	103,272	154,828	I. 51,556
Total mined	2,975,909	3,199,911	I. 224,002
Coke made	435,318	466,689	I. 31,371
Briquets made	307,479	297,371	D. 10,108

Asturias, Oviedo province, contributes more than half the total output of coal.

Spain's foreign trade in fuel, for the same years, amounted to:

Imports:	1904.	1905.	Changes.
Coal.....	2,129,893	2,206,398	I. 76,505
Coke.....	177,085	145,288	D. 31,797
Exports:			
Coal and coke...	2,767	2,171	D. 596

Most of the imports enter at Barcelona, Bilboa and Valencia.

Iron Trade Review.

NEW YORK, March 21.

There is no special feature in the iron market to indicate any material change from last week. Demand continues strong in a few lines, especially structural steel and plates. Building is extremely active and new projects continue to come forward. The railroads are also large buyers, both of rails and equipment.

Otherwise matters are quiet, so far as new business is concerned. There seems to be some hesitation as to business for the second half of the year. Furnaces and mills, however, are busy on existing orders. The coal situation has an effect on the market, and preparations are being made, wherever possible, for a temporary stoppage of supplies after April 1. The general anticipation, however, is that a strike will be short, if it comes at all.

Pig Iron Production—The weekly capacity of the coke and anthracite furnaces in blast on March 1 is reported at 482,150 tons, a decrease of 2400 tons as compared with March 1. The production of pig iron in February, taking the estimate made by the *Iron Age* for coke and anthracite furnaces and adding an allowance for the charcoal furnaces, was 2,916,000 tons; making a total of 5017 tons for two months of the current year.

Open-hearth Steel Production—The American Iron and Steel Association reports that the total production of open-hearth steel ingots and direct castings in the United States in 1905 was 8,971,376 long tons, against 5,908,166 tons in 1904; an increase of 3,063,210 tons, or 51.8 per cent. The production was much larger than in any previous year, and was only 1,969,999 tons less than the production of bessemer steel for the year. The production of open-hearth steel for two years past has been divided, by processes, as follows:

	1904. Tons.	1904. Per Ct.	1905. Tons.	1905. Per Ct.
Acid.....	801,799	13.6	1,155,648	12.9
Basic.....	5,106,367	86.4	7,815,728	87.1
Total.....	5,908,166	100.0	8,971,376	100.0

The increase in acid steel was 353,849 tons, or 44.1 per cent., and in basic steel 2,709,361 tons, or 53.1 per cent. The direct castings made—included in the totals above—reached, in 1905, a total of 526,540 tons, of which 206,159 tons, or 39 per cent. were basic, and 320,381 tons, or 61 per cent., were acid steel.

The open-hearth steel made in 1905, including both ingots and castings, was produced by 111 works in 17 States—Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Maryland, Alabama, Ohio, Indiana, Illinois, Michigan, Wisconsin, Missouri, Colorado, and California. Delaware and Michigan, neither of which made open-hearth steel in 1904, appear among the producers in 1905, and Tennessee, which was a producer in 1904, is omitted from the list of producers in 1905. Pennsylvania made 70.3 per cent. of the total production of basic steel ingots and castings in 1905 and 84.1 per cent. of the total production of acid steel ingots and castings, against 71.8 per cent. of basic and 79.6 per cent. of acid ingots and castings in 1904. Ohio and Illinois were the next largest producers of basic ingots and castings in each of these two years.

Birmingham. March 19.

The production of pig iron has been curtailed, several furnaces having been blown out for repairs. The demand is still steady, the production now being a little under what is required. The sales that are being made right now in this territory are in small lots, though it is stated that during the past week there were some inquiries for lots ranging from 1000 to 5000 tons each. There is not a large amount of iron on the yards hereabouts, and it is stated also that much of that here has been sold and only waits instructions to ship.

The subject of iron quotations is a hard one to report on definitely. In some quarters it is stated that No. 2 foundry is being held for between $14 and $14.50 per ton, while it is also heard that $14 has been scaled, the difference being equal to the advance in freight rates which went into effect on March 1.

The Sloss-Sheffield Steel and Iron Company has one furnace out; the Tennessee Coal, Iron and Railroad Company is repairing two furnaces at Bessemer; the Republic Iron and Steel Company has the big No. 3 furnace at Thomas out for repairs; two furnaces in the Sheffield district are out. The Alabama Consolidated Coal and Iron Company will blow out one of the Ironaton furnaces, while the Shelby Iron Company has one of its charcoal furnaces at Shelby out for repairs.

The following iron prices are given: No. 1 foundry, $14.50; No. 2 foundry, $14@14.50; No. 3 foundry, $13@13.50; No. 4 foundry, $13; gray forge, $12.50; No. 1 soft, $14.50; No. 2 soft, $14@14.50. These figures are given with knowledge of rumors that iron has sold at $13.75 for No. 2 foundry.

There is no change at the steel plants. Conditions remain unchanged at other iron and steel works. Cast-iron pipe makers report great activity in demand with prospects for continuation of this condition for some time.

Chicago. March 19.

The market for pig iron has been dull in the last week, and there has been much talk of cut prices on Southern iron below the $14 Birmingham ($17.90 Chicago) base for No. 2 that has been supposed to represent the bottom price on Southern for several weeks. Investigation seems to show that the lower prices have been on low-grade irons, or under circumstances more favorable to the seller than to the buyer. For ordinary sales the price apparently has not weakened. The demand is still greatest for small lots and for speedy deliveries, but some business is being done in contract iron and inquiries are good.

Indications point to continuance of the slackness of sales, the general tendency of melters being to withold the making of contracts for future supplies. This indicates a confidence in the ability to get iron promptly as it is needed, a condition that cannot prevail long if the history of the local market is a guide to the future. Some furnaces are already unable to supply foundry iron for at least three months hence, and Northern iron is generally becoming difficult to get in quick consignments. Northern No. 2 is quoted at $19@19.50, as last week.

Coke is steady at $5.65 for high-grade Connellsville.

Cleveland. March 19.

Iron Ore—The longshoremen and the dock managers failed to arrive at a settlement here last week and the conference adjourned without action. The longshoremen had taken the masters and pilots into affiliation and insisted upon a recognition of that union as a part of the longshoremen's agreement. The dock managers refused, as did the Lake Carriers' Association, hence the split. The adjournment is for two weeks and the belief is that the lakes will be tied up for at least a month after the channels are free of ice. This is strengthening the freight market and not so much talk is heard of a possible lowering of the wild rates at the opening of the season of navigation. Consumption of ore is heavy and the movement from the lake docks to the furnace stock piles continues.

Pig Iron—Current buying of foundry iron is about as it has been, a little easy with some of the furnaces anxious. Prices have continued to show a settling tendency. During the week, however, some consumers have shown a disposition to cover their needs past July 1, and this has had a strengthening influence. The market is represented by a quotation of $17 for No. 2 in the Valleys, the market being somewhat easy at that price.

Finished Material—Structural is still strong, with buyers forced to supply demands for quick shipment from the eastern mills at premium prices, and in some instances from the jobbers. No new tonnage is appearing, but indications are that buyers are getting ready to contract for third quarter. Plates are steady, with a good current demand and heavy specifications against old contracts. No new orders appear. Billets are still strong, with some of the material bought on speculation several months ago, coming upon the market and furnishing the desired supply. Bar iron is weak at 1.70c., Youngstown, partly due to lower scrap prices. Bar steel is strong except as to the smaller sizes. Sheets are steady to strong, with a good demand, most of which is supplied out of stock.

New York. March 21.

Pig Iron—Business has been quiet, though there is some inquiry, which may develop into business later. The present hesitation is largely due to uncertainty about the fuel situation. Outside of this, business is in a satisfactory condition.

For Northern iron, large lots, we quote: No. 1 X foundry, $18.25@18.75; No. 2 X, $17.75@18.25. No. 2 plain, $17.25@17.75; forge, $16.75@17.25. For Southern iron on dock prices are: No. 1 foundry, $18.25@18.50; No. 2, $17.75@18; No. 3, $17@17.50; No. 4, $16.25@17; No. 1 soft, $18.25 @18.50; No. 2 soft, $17.75@18; gray forge, $16.25@16.50. Basic is held at $19 for Virginia, $18.50 for Alabama and $18 for Northern.

Cast-Iron Pipe—Prices are steady, the present basis being $29.75 per net ton for 6-in. pipe in carload lots at tidewater points. The foundries are all supplied with work for some time ahead.

Bars—Business is slow, and prices are again off. Sales have been made at 1.645@1.695c. for common iron bars, and 1.745c. for refined iron. Steel bars are also lower, and sales are reported at 1.645c., tidewater. Store trade is easy, at 2c., delivered.

Plates—Steel plates are in steady demand. Tank plates are nominally 1.745@1.825c.; flange and boiler, 1.845@1.945c.; universal and sheared plates, 1.745@1.845c.; according to width.

Structural Material—Prices are nominally unchanged. Beams under 15 in. are 1.845c. for large lots; over 15 in., 1.895c.; angle and channels, 1.845c., tidewater delivery. Jobbers ask a considerable advance on small orders. New building projects are reported held up, owing to difficulty in getting material when needed. A good deal of bridge work is coming in.

Steel Rails—No change in standard sections. Light rails are in steady demand, prices ranging from $26 for 35 lb., up to $33 for 12-lb. rails. Orders for trolley rails are reported, including one for 5000 tons for an Eastern enterprise.

Old Material—Business is fairly active, and prices steady. No. 1 railroad wrought is $18@19: No. 1 yard wrought can be had for $17@18; machinery cast, $14@14.50; heavy steel melting scrap. $15@16.50. These prices are on cars, Jersey City or other terminal delivery. There have been some large sales of railroad scrap and old rails recently.

Philadelphia. March 21.

Pig Iron—The only noticeable activity in the pig-iron market in this locality during the past few days has been in basic, for which large purchases have been made on a basis of $17.50. There are further inquiries in the market and negotiations are pending today for deliveries to be made within 60 days and which will probably result in placing of contracts. There are also a number of inquiries of recent development from engineering plants for special kinds of pig. Quotations are being held firmly notwithstanding some conditional offers to place orders provided concessions will be made. The quotations are the same as they have been for some time and may be given at $19 for No. 1 X foundry; $18.50 for No. 2; $17.50 for No. 2 plain and $17 for best standard forge. The sales of standard forge at $16.50 represent quality and not concessions. Basic is quoted at $18 but has sold at 50c. less.

Steel Billets—It looks as though steel billets would sell very actively before long and that $30 would be the price. This is the billet man's side of the case. The buyers' side is that they have been paying no more than $29 and will be able to get all the billets they want at that price.

Bars—The inquiries this week have been for common iron for car-building purposes. Steel bars are still quoted at $1.63½; refined iron $1.73½ and common iron at 1.65@1.70c.

Sheets—All our mills report themselves busy today and the office people report a steady influx of business, though most of the orders are for small quantities.

Pipes and Tubes—The tube market is very strong and a great number of small orders have been placed. Boiler shops are busy; locomotive work is crowding in and the tube mills are well sold up.

Merchant Steel—The users of merchant steel in this territory are working up an immense quantity of steel but their contracts extend in some cases up to June and they are ordering material only as they need it.

Plates—The plate mill people say they have had a quiet week; nothing but the small business that comes along about this season of the year.

Structural Material—The structural-steel people are overrun with urgent requirements from bridge builders and engineering firms who have contracts for the construction of large buildings. The smaller buyers are doing their very best to close quickly for material that they will want for construction purposes during the second and third quarters of the year.

Steel Rails—The business for the past week is in excess of 50,000 tons. There is a good deal of business being done in trolley rails as well as some business for export and quite an amount in light sections for mines and the like.

Scrap—The scrap situation is more satisfactory but the sales are of small lots. No. 1 steel scrap has sold at $15.50; railroad scrap is not selling, but is held at $19.50; machinery scrap is offered at $16, though none is reported as having brought that price. Other kinds remain unchanged.

Pittsburg. March 20.

The bessemer pig-iron market continues quiet, but there are indications of increased activity in foundry and forge iron, and a general buying movement is likely to occur in a short time. One sale of 500 tons of bessemer iron was made during the week for delivery in April, the price being $17.50, Valley furnace. This appears to be the minimum price, except for 5000 tons or more, when it is likely 25c. less could be done. For single car-loads probably $17.75 would be paid. Sales of a couple of lots of foundry No. 2 of 500 tons each have just been made for delivery running through April at $17, Valley, and a sale of 1000 tons of gray forge is reported today, the price being $16.85, Pittsburg, the lowest of the year. The decline in prices here is attributed to some sharp cutting which is said to have been done by some northern Ohio furnaces. A number of inquiries have been received within the past few days for all grades of pig iron for second-quarter delivery. If the United States Steel Corporation comes into the market, as is expected, for additional bessemer iron for the next quarter, it undoubtedly will have the effect of considerably strengthening the market. Despite the fact that nearly all the blast furnaces in the Pittsburg and Valley districts are in full operation, there is not a great deal of iron in sight for first-half delivery, the Bessemer Pig-Iron Association announcing that it has but 35,000 tons of bessemer and 15,000 tons of basic not under contract. One of the leading independent interests is almost entirely sold up to July 1. Production of pig iron is the heaviest on record. High prices for ferro-manganese continue, due not only to scarcity but to heavy consumption, and it is not likely that less than $100 a ton can be done before July 1, and possibly not until late in the third quarter.

All the iron and steel mills in the Pittsburg district are busy, and from present

indications will continue busy, whether there is a coal strike or not. Some great stocks of coal have been accumulated and the United States Steel Corporation, in addition to its big supply on the rivers, is storing coal on all the available property around its mills. Although the rivers were navigable last week and there is still a good boating stage, no coal was sent to the lower markets. It is evidently being held here in anticipation of fancy prices in the event of a strike. New business in structural material seems to be coming in at a greater rate than production, as the mills have been in steady operation and have as large a tonnage on the books as there was six months ago. It is doubtful if any of the producers could accept a big order for delivery before the latter part of the third quarter. Some fabricating concerns and dealers have laid in large stocks and will be able to take care of the small trade during the summer. Rail orders are still being booked and the mills are filled up through the third quarter. It is reported that some railroads are figuring on placing contracts for steel freight cars, although it will be impossible to get deliveries this year. It is believed that a large contract or two for cars would precipitate a buying movement. The plate mills are all busy and prices remain firm. The merchant steel-bar market continues firm, but there has been a slight decline in iron bars, a drop of $1 a ton in prices being noted this week, making the rate 1.65c. Youngstown or 1.69¼c. Pittsburg. The examination of the sales sheets of the Republic Iron and Steel Company last week to determine the wage rate for skilled men under the Amalgamated Association scale resulted in a surprise. It showed that despite some large old contracts taken at a low rate, the average price of common iron bars for January and February was 1.60c. Wages of puddlers advanced from $5.75 to $6 a ton and the pay of the finishers was increased 2 per cent. Owing to the scarcity of skilled iron workers the increased wage rate will be put in force at a number of non-union mills.

Pig Iron—Several sales of all grades of pig iron were made during the week in small lots, but the total was about 5000 tons. Prices are as follows: Bessemer, $17.50; basic and foundry No. 2, $17, all at Valley furnaces; gray forge, $16.85@17.10, Pittsburg.

Steel—The market is quiet. Bessemer billets remain at $27 and open-hearth at $27.50@28. Plates are firm at 1.60c. and merchant steel bars at 1.50c.

Sheets—While there is not much new business, specifications on old contracts are satisfactory and the mills are busy. Black plates are still quoted at 2.40c. and galvanized at 3.45c. for No. 28 gage.

Ferro-Manganese—The market continues strong and for prompt delivery $135 to $150 a ton is quoted.

London. March 10.

The British Iron Trade Association has collected and published the figures for the production of bessemer steel in 1905. The total make for the year was 2,009,712 long tons, an increase of 228,179 tons, or 12.8 per cent., over 1904. The figures for the two years are as follows:

	1904. Tons.	Per Ct.	1905. Tons.	Per Ct.
Acid	1,129,224	63.4	1,117,731	55.6
Basic	652,309	36.6	891,981	44.4
Total	1,781,533	100.0	2,009,712	100.0

There was an increase, therefore, of 239,672 tons, or 36.8 per cent., in basic converter steel, while the acid steel shows a decrease of 11,493 tons, or 1 per cent. in acid steel. The growth in the basic process was the feature of the year.

The following is an abstract of the output of semi-finished and finished bessemer steel of which returns have been made for 1905:

Rails	951,552
Bars	288,980
Blooms and billets	286,082
General merchant steel	187,973
Total	1,714,587

This total falls short of the ingots produced by 295,125 tons, which difference is made up by loss in conversion and by the unascertained output of fish-plates, castings, plates, sheets and other products, of which the quantity produced is relatively small. The rail production shows an increase of 33,178 tons over 1904.

The total number of converters reported was 76, of which 60 were in use and 16 idle during the year. The average make per converter in use was 33,495 tons.

Dusseldorf, Germany. March 8.

The output of the German blast furnaces in January shows a large gain over the corresponding month last year, when production was reduced by short supplies of fuel. The figures for the month, as compiled by the German Iron and Steel Union, are as follows, in metric tons:

	1905. Tons.	Per Ct.	1906. Tons.	Per Ct.
Foundry iron	147,878	19.3	165,014	16.2
Forge iron	60,602	7.9	74,196	7.3
Steel pig	51,303	6.8	81,820	8.0
Bessemer pig	31,805	4.1	41,101	4.0
Thomas pig	474.621	61.9	656,330	64.5
Total	766,209	100.0	1,018,461	100.0

Steel pig in the German classification includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys used in steel making. The increases shown are in foundry iron, 17,136 tons; forge iron. 13,594; steel pig, 30,517; bessemer, 9296; Thomas, or basic, pig, 181,709; the total gain being 252,252 tons, or 22.9 per cent. The largest production this year was 416,606 tons in the Rhenish-Westphalian district; Lothringen and Luxemberg coming next, with 317,659 tons.

The production of coal in Germany for the month of January is reported as follows, in metric tons:

	1905.	1906.	Changes.
Coal	7,590,980	11,881,344	I. 4,290,364
Brown coal	4,462,998	5,116,227	I. 653,229
Total mined	12,053,978	16,997,571	I. 4,943,593
Coke made	780,461	1,608,493	I. 828,032
Briquets made	957,592	1,266,794	I. 309,202

The large increase shown this year is due to the fact that the output in 1905 was reduced by the strike of the mines in the Rhenish-Westphalian district.

Heavy Chemicals and Minerals

NEW YORK, March 21.

Heavy chemicals show decided strength in several lines. The quotations are shown in the table given herewith; and in particular:

Carnotite, low grade, with 3 to 5 per cent. uranium oxide, U_3O_8, $8 to $10 per unit; this is penalized for copper or high lime, and is favored for vanadium content.

Nitrate of Soda—Conditions on the west coast (of South America) are looking better, and the market is stiffening, though recent quotations are not yet advanced.

Phosphate—The market is much stiffer on account of an apparent shortage for 1906; in accord with which quotations hold their own in the recent advances, as shown in the table given herewith.

Potash Salts—These products still continue interesting. The German syndicate has adjusted its difficulties with the independents and has withdrawn its proposal for an export tax. New quotations were announced by the American agents of the German Kali Syndicate on March 19, to wit: the old quotations to hold for a fortnight; after that, an advance of 0.3c. on 100 lb. for sulphate and muriate, and about 25c. per ton advance on kainite.

Sulphur—The American quotations are the same as those recently reported; but, regarding the future, Emil Fog & Sons, of Messina, report that the Anglo-Sicilian Company has decided to rescind its contract, which expires on July 31, 1906. "In order to replace the retiring company the Sicilian mine owners are going to form a new trust. As it would be impossible to unite them all by free will under one head, a law will be presented to parliament making it compulsory on all interested to form part of the new combine. This 'Consorzio Obbligatorio' will dispose of the whole Sicilian production and will exercise a more complete monopoly than the Anglo-Sicilian ever could, absorbing all the former dissidents. Delegates representative of the mining interests are actually treating in Rome with the Anglo-Sicilian and with the American representative of the Louisiana interests. They hope to obtain from the Anglo-Sicilian an extension of time for the sale of accumulated stocks, which the Consorzio Obbligatorio is asked to take over; and to liquidate with the old company. A trust imposed by law, de-

priving the individual of his rights of property, would certainly constitute a novel experiment. However, the agitation is so strong, and the fear of disturbances so intense, that the law referred to has every probability of being passed. All agree that the chief remedy against the impending crisis must be a reduction of the production. But how bring it about without reducing the number of hands employed in the mines? Many Sicily mine-owners still profess to disbelieve in the Louisiana production; this, however, seems proved beyond doubt. We read in American journals that the output of the Louisiana mines last year was 175,000 tons, being confronted on the other hand by a largely increased American consumption. It appears that last year the Louisiana mines were not yet able to provide for the entire home consumption, and Sicily had to be drawn upon for the deficiency (70,000 tons). According to the report published by the Italian Mining School at Caltanissetta, in December, 1905, the Louisiana output will shortly reach 400,000 tons; if this is correct, America would no longer need Sicilian sulphur. In fact, it is reported that the American representative, in the treaties now proceeding at Rome, insists on reserving the whole American market for the home product. Sicilian stocks at the end of Jan., 1906, increased to 476,764 tons, against 378,195 tons in the preceding year; the new Consorzio therefore will have a formidable problem to solve."

PRICES.

Alkalies.	
Soda ash, per lb., future	0.80@.87½c.
" " " prompt	.85@.95c.
Bicarb. soda, per lb	1.3@1.5c.
Bleaching powder, per lb	1.2@1.25c.
Soda, caustic, per lb., future	1¾@1.8c.
" " " April prompt	2½@3c.
Salt cake, per lb	.65c
Sal soda, per lb	.6@1.4c.
Soda, monohydrate, per lb	1¼@1¾c.
Potash, caustic, per lb	4½@5¼c.
" carbonate, 82-85%	3¾@4¼
Alum, per lb	1.75@1.95c.
Ammonia, aqua, 26 deg., per lb	4¾@5¾c.
Acids.	
Carbonic, liquid gas	" .12½
Hydrochloric, nominal, per lb	1.1c.
Hydrofluoric, 30%	per lb. .03
48%	" .05
60%	" .11
Nitric acid	per lb. 3¾@5¾c.
Oxalic acid, com'l, per lb	5¾@6½c.
Sulphuric acid, 50°, bulk, per ton	$12 up.
60°, 100 lb. in carboys	1.00
60°, bulk, ton.	18.00@20.00
66°, 100 lb. in carboys	1.00@1.25
66°, bulk, ton	21.00@23.02
Arsenic, white, per lb., nominal	5¾@7¼c.
Blue Stone (copper sulphate), carload	$5.80
small lots	6.50
Nitrate of soda, 100 lb. 96% to July	$2.27½@2.30
95% to July	2.25@2.27
95% July to Dec.	2.25@2.27
95% " " "	2 22½ spot, $2.25
Saltpeter, per lb	4¾@5½c.
Potash, muriate, per cwt	$1.90@$1.98
Potash, kainite, per long ton	8.50@9.50
Potash, sulphate, 90%, 100 lb	$2.18@2.21¼
Sulphate of ammonia, per 100 lb	3.10@3.12½
Sulphur.	
Louisiana (prime) to New York, Boston or Portland, ton	$22.12½
To Philadelphia or Baltimore "	22.62½
Tin, bichloride per lb	.10½
Crystals, per lb	.22½
Pyrite.	
Domestic, furnace size, Unit	10½@11c.
Fines "	8@10c.
Imported, lump, At. ports "	11@12c.
" fines " " "	10@10½c.
" furnace size "	11@12c.

Pyrite prices are per unit of sulphur. On lump deliveries, a charge of 25c. per ton is made for breaking to furnace size.

Phosphates.	F. O. B.	
*Fla., hard rock	$3.00@3.50	
land pebble	4.50@5.00	
†Tenn., 78@80%	4.60@4.65	
78%	4.00@4.25	
75%	3.75@4.00	
68@72%	3.25@3.50	
‡So. Car. land rock	4.00@4.25	
river rock	3.75@4.00	

*F. o. b. Florida or Georgia ports. †F. o. b. M Pleasant. ‡On vessel Ashley River, S. C.

Metal Market.

New York, March 21.

Gold and Silver Exports and Imports.

At all United States Ports in February and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1906	$7,686,330	$2,083,938	Exp. $5,605,392
" 1905	14,794,312	2,192 919	" 12,601,393
Year 1906	13,427,995	4,689,647	" 8,783,348
" 1905	31,622,480	4,088,610	" 27,533,870
Silver:			
Feb. 1906	7,235,129	4,451,376	Exp. 2,783,753
" 1905	4,036,075	2,061,358	" 1,974,717
Year 1906	14,751,797	9,138,087	" 5,613,710
" 1905	8,400,820	3,983,560	" 4,417,260

These statements cover the total movement of gold and silver to and from the United States. The figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

Gold and Silver Exports and Imports, N.Y.

For the week ending March 17, and for years from January 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week	.....	$ 23,028	$ 680,740	$ 27,219
1906	3,027,379	482,185	16,365,971	394,550
1905	30,138,071	2,220,118	8,041,840	591,840
1904	1,911,660	1,105,039	11,290,890	171,775

No gold exported during the week; the silver all went to London. Imports for the week were from the West Indies and South America.

Exports of merchandise from the United States in February were valued at $141,719,650. the largest for that month in a number of years. For the two months ending Feb. 28 the statement of the Bureau of Statistics of the Department of Commerce and Industry is as follows:

	1905.	1906.
Exports	$230,468,165	$312,324,537
Imports	201,427,289	210,723,409
Excess, exports	$ 29,040,876	$101,601,128
Add ex. of exp., silver		5,613,710
" " " gold		8,738,348
Total export balance		$115,953,186

The gold and silver movement in detail will be found in the table at the head of this column.

The following table shows the specie holdings of the leading banks of the world. The amounts are reduced to dollars:

	Gold.	Silver.	Total.
New York	.....	.....	$180,451,700
England	$190,560,015	.....	190,560,015
France	579,052,015	$209,517,650	788,569,675
Germany	181,360,000	60,450,000	241,810,000
Spain	75,365,000	117,625,000	192,990,000
Netherlands	30,263,500	30,403,500	60,667,000
Belgium	17,143,335	8,536,665	25,680,000
Italy	141,435,000	19,185,000	160,620,000
Russia	469,150,000	21,590,000	490,740,000
Austria	229,235,000	63,455,000	292,690,000

The returns of the associated banks of New York are of date March 17, and the others March 16. The foreign bank statements are from the *Commercial and Financial Chronicle*, of New York. The New York banks do not separate gold and silver in their reports.

The statement of the New York banks —including all the banks represented in the clearing house—for the week ending March 17, gives the folowing totals, comparison being made with the corresponding week of 1905:

	1905.	1906.
Loans and discounts	$1,127,678,400	$1,025,432,400
Deposits	1,174,438,100	1,008,868,700
Circulation	42,803,500	50,920,700
Specie	215,060,000	180,451,700
Legal tenders	83,703,700	77,630,600
Total Reserve	$298,763,700	$258,082,300
Legal requirements	293,609,525	252,217,175
Surplus reserve	$5,154,175	$5,864,125

Changes for the week this year were increases of $5,852,900 in loans, $1,783,700 in specie and $6,936,700 in deposits; decreases of $648,100 in legal tenders $518,000 in circulation and $598,575 in surplus reserve.

Shipments of silver from London to the East are reported by Messrs. Pixley & Abell as follows, for the year to March 8.

	1905.	1906.	Changes.
India	£ 1,644,887	£ 4,109,910	I. £ 2,465,023
China	1,370	.....	D. 1,370
Straits	2,800	.....	D. 2,800
Total	£ 1,649,057	£ 4,109,910	I. £ 2,460,853

Imports for the week were £17,000 from the West Indies, and £214,000 from New York; a total of £231,000. Exports were £210,000 to India.

Indian exchange is a little easier, and the Council bills offered in London were taken at an average of 16.04d. per rupee. Shipments of silver to India continue at a fair rate.

The silver market has shown tendency to firmness, though inquiry has not been for large amounts. Price has advanced again to 30 1/8d. in London under renewed but quiet purchases on behalf of the Indian Government.

SILVER AND STERLING EXCHANGE.

Mar.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Mar.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
15	4.85⅛	64⅝	29⅞	19	4.8560	65	30
16	4.85⅝	64⅞	29⅝	20	4.85⅛	65⅛	30⅛
17	4.85⅝	65	30 1/16	21	4.85⅛	65¼	30⅛

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, .925 fine.

Prices of Foreign Coins.

	Bid.	Asked.
Mexican dollars	$0.50	$0.53
Peruvian soles and Chilean	0.46	0.49
Victoria sovereigns	4.85⅛	4.87⅛
Twenty francs	3.87	3.89
Spanish 25 pesetas	4.78	4.80

Other Metals.

Daily Prices of Metals in New York.

March.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
15	18⅛ @18¾	18¼ @18⅝	80 1/16	36⅛	5.35	6.20 @6.25	6.05 @6.10
16	18⅛ @18¾	18¼ @18⅝	80 1/16	36¾	5.35	6.20 @6.25	6.05 @6.10
17	18⅛ @18¾	18¼ @18⅝	.....	36¾	5.35	6.20 @6.25	6.05 @6.10
19	18⅝ @18¾	18¾ @18½	81¼	37	5.35	6.15 @6.20	6.00 @6.05
20	18⅝ @18¾	18¾ @18½	81⅛	37	5.35	6.15 @6.20	6.00 @6.05
21	18⅝ @18¾	18¾ @18½	81¼	37⅛	5.35	6.15 @6.20	6.00 @6.05

London quotations are per long ton (2,240 lb.) standard copper, which is now the equivalent of the former g. m. b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars. The price of cathodes is usually 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting & Refining Co. for near-by shipments of desilverized lead in 50-ton lots, or larger orders. The quotations in spelter are for ordinary western brands; special brands command a premium.

Copper—A fairly large business has been done in this market at current prices with home consumers, and the demand from abroad, which had fallen off in consequence of purchases that were made in China, has also become better again. Quotations are practically unchanged and close at 18⅝@18¾ for Lake copper; 18¼ @18½ for electrolytic in ingots, cakes and wire bars; 17¾@18¼ for casting copper.

The shortage of speculative copper in the London market still remains acute, and bears who had to cover their contracts were forced to do so at advancing prices. The market closes at £81 5s. for spot, £78 15s. for three months.

Statistics for the first half of the current month show an increase in the visible supplies of 350 tons. Exports to Great Britain this year have been light. as shown below; those to Germany have kept up much better.

Exports of copper from New York for the week were 2517 tons. Our special correspondent reports the exports from Baltimore at 1147 long tons of fine copper.

Imports and exports of copper in Great Britain for the two months ending Feb. 28 were as follows, the totals giving the copper contents of all material reported; the figures are in long tons:

	1905.	1906.	Changes
Copper ore	16,246	19,146	I. 2,900
Matte and precipitate	10,836	14,361	I. 3,525
Fine copper	13,347	10,297	D. 3,050
Total, fine copper	20,390	20,023	D. 367
Exports	6,033	7,261	I. 1,228
Net imports	14,357	12,762	D. 1,595

Of the imports this year 937 tons of matte and 3380 tons of fine copper were from the United States; against 447 tons of matte and 7089 tons of fine copper last year.

Tin—The market here rules very firm, and as spot supplies are exceedingly scarce, a premium is readily paid where immediate delivery is wanted. Advices of shipments from the Straits have also been of comparatively small volume, in consequence of which London operators are trying to buy up all the near-by metal they can lay their hands on. Quotations at the close are firm at 37@37¼c. in our market, £167 10s. for spot, £165 15s. for three months in London.

Imports and exports of tin in Great Britain for the two months ending Feb. 28, including re-exports of foreign metal, were as follows, in long tons:

	1905.	1906.	Changes.
Straits	5,841	6,322	I. 481
Australia	652	774	I. 122
Other Countries	117	356	I. 239
Total imports	6,610	7,452	I. 842
Re-exports	5,805	5,926	I. 121
Exports	973	*1,089	I. 116
Total	6,778	7,015	I. 237
Balance	E. 168	I. 437	.....

Re-exports were largely of Straits tin to the United States.

Lead—During the last few days the demand for this metal has become a little brisker, but all business can easily be placed on a basis of the schedule of the American Smelting and Refining Company, which remains unchanged at 5.35c. New York.

The London market, where a scarcity of near-by lead is noticeable, continues firm and closes at £15 1s. 3d. for Spanish lead, £16 3s. 9d. for English lead.

Imports and exports of lead in Great Britain for the two months ending Feb. 28 were as follows, in long tons:

	1905.	1906.	Changes.
United States	3,118	2,530	D. 588
Spain	17,486	15,572	D. 1,914
Australia	19,191	8,814	D. 10,377
Germany	2,521	2,888	I. 367
Other countries	344	627	I. 283
Total imports	42,660	30,431	D. 12,229
Exports	5,864	8,115	I. 2,251
Balance	36,796	22,316	D. 14,480

The lead credited to the United States is chiefly Mexican lead, refined here in bond.

Spelter—The tone of the market is very soft, brought about mainly by the absence of any consumptive demand. First hands are quite willing to sell their current production at 6@6.05 St. Louis, 6.15@6.20c. New York.

The London market remains steady and closes at £24 15s. for good ordinaries, £25 for specials.

Late reports from Belgium say that serious floods have occurred in Belgium, interfering with shipments of spelter. The same cause has temporarily stopped production by the second largest works in Belgium.

Imports and exports of spelter in Great Britain for the two months ending Feb. 28 were as follows, in long tons:

	1905.	1906.	Changes.
Spelter	14,386	17,214	I. 2,828
Zinc sheets	3,074	2,823	D. 251
Total imports	17,460	20,037	I. 2,577
Exports	1,274	960	D. 314
Balance	16,186	19,077	I. 2,891

Imports of zinc ores are not reported separately in the returns.

Zinc Sheets—The price of zinc sheets is $7.75 per 100 lb. (less discount of 8 per cent.) f.o.b. cars for Lasalle and Peru, in 600-lb. cases for gages No. 9 to 22, both inclusive, widths from 32 to 60 in., both inclusive, and lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 lb. The fluctuations in the base price for sheet zinc since January 1, 1096, have been as follows: Jan. 6, 1906, $8; Feb. 5, $7.75.

Antimony remains very scarce, and quotations are unchanged at 17@18c. for Cookson's; 16½@17c. for Hallett's, and 16@16½ for other brands; all for prompt delivery.

Nickel—Quotations for large lots, New York, or other parallel delivery, are 40@ 47c. per lb., according to size and condition of order. For small quantities, prices range from 48c. up to 60c., also according to size of order and deliveries.

Platinum—Prices are still unsettled, the supply being irregular and the demand large. The current price is $25 per ounce, but changes are likely to occur at any time.

Quicksilver—The metal is firm and New York prices are still $41 per flask of 75 lb. for lots of 100 flasks or over, and $42 for small lots down to 10 flasks. For retail quantities, under 10 flasks, pound prices are charged, which work out to $43.50@44 per flask. San Francisco prices are firm at $39.50 for domestic orders and $38 for export. The London price is £7 7s. 6d. per flask, but jobbers ask £7 10s. for moderate lots.

Imports of quicksilver into Great Britain for the two months ending Feb. 28 were 381,920 lb. in 1905, and only 7882 in 1906. Exports were 393,880 lb. in 1905, and 569,006 lb. in 1906. These exports were from accumulated stocks.

Missouri Ore Market.

JOPLIN, March 17.

The highest price paid for zinc was $49 per ton, $1 less than a week ago, because no fancy-grade ore was sold; but the assay basis price is without change at $43@ 46 per ton of 60 per cent. zinc. Average, $42.62.

The highest price paid for lead was $79 per ton; the Picher Lead Company, of Joplin, forcing prices up to a much higher scale, and securing a large proportion of

ore that the St. Louis Smelting and Refining Company has been getting. The average price was $75.22.

The district value for the eleven weeks of the year has passed three millions of dollars, being nearly half a million dollars ahead of last year. The zinc shipment for this period is 9283 tons and lead 2986 tons larger than a year ago. Zinc this week is the same price as a year ago, but lead is $12 per ton higher.

Some anxiety is being felt as to the probable outcome of the threatened strike among coal miners on April 1, as it is feared that both mining and smelting will be seriously affected.

Following are the shipments for the week ended today:

	Zinc, lb.	Lead, lb.	Value.
Carterville-Webb City..	2,775,180	600,740	$83,875
Joplin	2,674,580	183,660	67,160
Duenweg	908,280	203,050	27,690
Galena-Empire	694,570	186,180	20,770
Aurora	712,900	61,230	15,390
Neck City	592,040	.....	13,610
Granby	690,000	20,000	11,640
Badger-Peacock	405,790	.....	8,930
Oronogo	362,720	2,740	8,155
Alba	322,590	2,700	7,515
Prosperity	126,000	55,240	5,250
Carthage	160,000	.....	3,680
Baxter Springs	180,380	.....	3,610
Central City	156,000	.....	3,120
Spurgeon	87,990	22,500	2,060
Zincite	85,590	.....	1,880
Totals	10,934 870	1,338,040	$284,335

Eleven weeks	109.529.690	16,463,160	$3,047,540
Eleven weeks, 1905	90,963,800	10,491.330	2,596,830

Zinc value, the week, $234,010; 11 weeks, $2,477,000.
Lead value, the week, 50,325; 11 weeks, 570,540.

The following table shows the average monthly prices of zinc and lead ores in Joplin, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1905.	1906.	Month.	1905.	1906.
January	52.00	47.38	January	61.50	75.20
February	52.77	47.37	February	57.62	72.83
March	47.40	....	March	57.20	....
April	42.88	....	April	58.00	....
May	43.31	....	May	58.27	....
June	40.75	....	June	57.80	....
July	43.00	....	July	58.66	..
August	48.83	....	August	58.00	....
September	46.75	....	September	63.50	....
October	47.60	....	October	63.86	....
November	49.55	....	November	68.67	....
December	49.00	....	December	76.25	....

Wisconsin Ore Market.

PLATTEVILLE, March 17.

The local zinc and lead market is quite steady, although there was seeming disposition on the part of one of the buyers to force the price down a little. With this one exception, business was quite brisk and ore in good demand, 60 per cent. zinc ore selling at $46@48 per ton. Low-grade ore strong, but only a little reported as being sold.

Considerable attention is being paid to prospecting and the results are highly satisfactory. The great number of strikes reported show conclusively that the Wisconsin zinc district is of a more permanent nature than at first supposed. During February the number of prospects nearing the producing stage was greater than at any other time in the history of this district.

Lead remains about the same as last week, as do sulphur and drybone.

The camps of the Platteville district report ore loaded as follows:

Camps.	Zinc, Lb.	Lead, Lb.	Sulphur, Lb.
Platteville	387,970	.....	.....
Buncombe-Hazel Green	372,600	.....	.....
Cuba City	350,000	.....	.....
Highland	190,750	.....	.....
Linden	110,770	.....	.....
Benton	60,000	.....	.....
Harker	53,580	.....	.....
Livingston	50,000	.....	.....
Montfort	.....	.....	58,000
Total	1,575,670	.....	58,000
Year to Mar. 17	15,978,650	657,770	1,971,040

The uncertainty about fuel supply is making buyers cautious.

Mining Stocks.

New York. March 21.

Dullness and comparatively light transactions marked the Stock Exchange record for the week. It is, perhaps, unnecessary to add that prices did not improve.

Amalgamated Copper sold down to $103½, closing a fraction below that. American Smelting and Refining closed at $153¾ for the common, and $120¾ for the preferred. Sloss-Sheffield sold for $79. United States Steel closes dull and heavy at $104¾ for the preferred and $39¼ for the common stock.

On the outside market the copper stocks were heavy, on moderate trading. Greene-Copper was off a little, to $28¾; Mitchell Mining brought $12½. Nevada Consolidated held its own at $19. Outside of the copper there was some trading in Tonopah Extension, which brought $12 at the close.

Boston. March 20.

The mining-share market has been a soft one, in sympathy with the New York list, the past week. Amalgamated and United Copper have been the weakest stocks and have had the most pronounced fluctuations; but this is not surprising, in view of the fact that the headquarters for both are in New York. Low prices were made on Monday, the day of the greatest depression. The former touched $103.50, but rallied to $105.50 tonight, which is $3 below a week ago. United Copper fell to $65, ex-dividend, today, closing at $66, against $72.37½ a week ago. This stock, together with North Butte, has received continued attacks from Lawson, but with little effect marketwise. North Butte touched $79.75 today, but easily recovered to $81.50, a net loss of $1.50 for the week. In keeping with New York, the list hardened the latter part of the day and closed buoyant. Osceola is off $2 to $100, with no significance in the trading.

As yet the advent of tickers in New York giving Boston quotations has not borne fruit, but it is early yet to draw any conclusions. Later developments may prove profitable.

Winona advanced $1 to $9.50 on the announcement that the board of directors will be reorganized and made up of Boston gentlemen. United States Smelting is up $1.25 to $57, and United States directors have declared an initial dividend on the preferred stock of 1¾ per cent. on par $50. Action on the common dividend has been postponed for the present.

Colorado Springs. March 16.

There has been little excitement on the local exchange. El Paso has furnished the only feature, and has monopolized the bulk of the trading. This stock has been gaining in price during the week and it is reported that those in control are doing most of the buying. The C. K. & N. vein is said to be proving up well, and some brokers predict $1 for El Paso within a few days.

Portland has been traded in at about the same figures as last week, $1.84@1.85. Findley has advanced slightly, selling today for 75½. Vindicator sells for 93c.; Isabella 27c.; Gold Sovereign sold down to 7½ on today's call. Elkton is quoted at 39½@40c.; C. K. & N. 8½@10½. United Gold Mines has been selling for 12c., closing at that figure.

San Francisco. March 15.

The Comstock market picked up this week and showed more activity than for many weeks past. No definite cause exists for this spurt, and it seems to be a sort of reflex action from the other side of the house. It astonished some of the old hands.

The Tonopahs were strong and active. The public seems to have realized the possibilities in these stocks, and is buying freely. On the Tonopah side there is a liveliness which recalls old times. New issues are constantly brought forward, and all of them seem to find a market. Prices of the older issues are firm and advancing.

The sworn returns of the mining companies as filed in their offices this week, showed cash on hand March 1 as follows, with all expenses paid, unless otherwise noted: Alpha Consolidated, $2017; Alta, $280, with liabilities of $5608; Andes, $7622; Belcher, $4792; Best & Belcher, $4136; Bullion, $778; Caledonia, $3399, with February expenses unpaid; Confidence, $1442, with February expenses unpaid; Crown Point, $1067; Chollar, $2961; Consolidated California & Virginia, $23,831; Challenge Consolidated, $921; Consolidated Imperial, $1732; Exchequer, $2467; Gould & Curry, $1133, with bills payable of $390, and liabilities of $1750; Julia Consolidated, $496; Consolidated New York, $495; Ophir, $59,369; Overman, $4169, with February expenses unpaid; Potosi, $3730; Savage, $2001; Segregated Belcher, $263, with indebtedness of $1100; Scorpion, $33; Sierra Nevada, $955, besides balance of $2723 in Virginia City; Silver Hill, $15,165; Union Consol-

idated, $1323. Hale & Norcross reports no cash on hand, with $1302 indebtedness.

Dividends.

Company.	Payable.	Rate.	Amt.
Am. Smelting & Ref.	Apr. 16	$1.75	$875,000
Am. Smelting & Ref., pfd.	Apr. 2	1.75	875,000
Con. Mercur	Mch. 26	0 02½	25,000
Copper Range Con	Mar. 31	1.25	.....
General Chemical, pfd.	Apr. 2	1.50	150,000
Guggenheim Exploration	Apr. 2	1.75	183,750
Homestake, S. D.	Mar. 26	0.50	109,200
Iron Silver	Apr. 2	0.20	100,000
N. Y. & Honduras Rosario	Mar. 24	0.10	15,000
Teziutlan Copper	Apr. 2	2.00	160,000
Tonopah Extension	Mar. 20	0.10	100,000
United Copper	Apr. 30	1.75	767,500
United Copper, pfd	May 15	3.00	150,000
Wolverine	Apr. 2	8.00	480,000
Va.-Carolina Chemical, pfd.	Mar. 31	2.00	360,000

*Monthly. §Bi-monthly. †Quarterly. ‡Semi-Annually.

Assessments.

Company.	Delinq.	Sale.	Amt.
Andes	Mar. 9	Mar. 30	$0.10
Christmas, Utah	Apr. 16	May 5	0.00½
Gould & Curry	Apr. 3	Apr. 23	0.10
Hale & Norcross	Mar. 2	Mar. 27	0.10
Julia Con	Apr. 9	Apr. 27	0.03
Kentuck Con	Apr. 11	May 4	0.05
Lower Mammoth, Utah	Mar. 19	Apr. 9	....
New Red Wing, Utah	Mch. 17	Apr. 7	0.02
Pioneer, Utah	Mch. 15	Apr. 7	0.01
Pinos Altos, N. M.	Mar. 26	.....	1.00
Red Slide, Cal.	Apr. 10	.....	0.05
Segregated Belcher	Apr. 5	Apr. 26	0 05
Savage, Nev.	Mch. 14	Apr. 3	0.10
Union Con., Nev	Apr. 10	Apr. 30	0.10
Wabash, Utah	Mch. 15	Apr. 4	0.10

Tonopah Stocks. Mar. 21.

(Revised by Weir Bros. & Co., New York.)

	High.	Low.	Last.
Tonopah Mine of Nevada	18.50	18.25	18.50
Tonopah Montana	3.10	3.00	3.05
Tonopah Extension	12.50	12.25	12.37½
Tonopah Midway	2.15	2.40	2.42½
Tonopah West End	2.95	2.90	2.90
Goldfield Mining Co.	.67	.65	.66
Jumbo Mining	1.53	1.50	1.52
Red Top	2.05	2.00	2.02½
Sandstorm	1.45	1.40	1.42
Montgomery Shoshone Cons.	19.00	18.50	18.75
Eclipse-Bullfrog	1.20	1.10	1.15
Denver-Bullfrog	1.80	1.75	1.80

St. Louis. Mar. 17.

	High.	Low.
Adams	$ .40	$ .25
American Nettie	.17	.12
Center Creek	2.60	2.40
Central Coal & Coke	61.00	61.00
" " " pfd.	80.00	76.00
Central Oil	60.00	55.00
Columbia	1.50	.50
Con. Coal	20.00	17.00
Doe Run (old stock)	400.00	300.00
Granite Bimetallic	.28	.20
St. Joe (old stock)	35.00	32.00

LONDON. (*By Cable.**) Mar. 21.

	£	s.	d.
Dolores	1	17	6
Stratton's Independence	0	7	9
Camp Bird	1	2	6
Esperanza	4	3	10½
Tomboy	1	6	3
El Oro	1	8	0
Oroville	0	19	0
Arizona Copper, pf.	3	6	6
Arizona Copper, def.	3	6	0

*Furnished by C. Schumacher & Co., New York.

PHILADELPHIA.

Cambria Steel	36⅛	36⅛	35⅛	35⅜
Philadelphia Co.	50⅞	51	50⅜	50⅜
Tonopah	19	19	18	18½

PITTSBURG.

Crucible Steel	15⅛	15⅛	14	14
Crucible Steel, Pref.	81¾	81¾	78⅛	78⅛
Tonopah Ext	13¼	13¼	11⅞	12¼

STOCK QUOTATIONS.

NEW YORK. Week Mar. 20.

Name of Company.	High	Low	Clg.	Sales
Amalgamated	108	103	103	429,600
Anaconda	274¾	260	260	163,250
Boston Copper	25⅛	20⅝	22⅜	24,600
British Col. Copper	9⅛	8	8	12,020
Federal, Pf.	105¾	102⅛	102⅞	3,900
Greene Copper	29⅛	28⅝	28⅝	10,900
Greene Gold	3⅞	3½	3⅝	5,200
Homestake				
Mitchell	12½	12	12	3,695
Tennessee Copper	47	44½	45	4,300
Union Copper	1⅞	1⅜	1½	8,800
United Copper	72¾	64¾	64¾	45,700
United Copper, Pref.	105	100	102	110
Utah Apex	7⅛	6¾	6¾	750
Utah Copper	31	28	28	1,610

NEW YORK INDUSTRIALS.

Am. Smelting & Ref.	161¾	153¼	153¼	144,950
Am. Smelting & Ref., Pf.	124¼	120¾	120¾	3,141
Col. Fuel & Iron	65⅞	59½	59½	58,000
National Lead	85	75⅛	75½	29,215
Pittsburg Coal, Pf.	54⅛	54	54½	200
Republic I. & S.	30½	28	28	1,800
Republic I. & S., Pf.	105½	98¾	98¾	2,920
Tenn. C. & I.	151⅛	149	149	600
U. S. Red. & Ref.	26½	26	26	200
U. S. Red. & Ref., Pf.	65¾	63	63	1,100
U. S. Steel	41⅛	39½	39½	221,320
U. S. Steel, Pf.	106¼	104¾	104⅞	44,535
Standard Oil	670	650	656	
Bethlehem Steel	28½	*26	26	100

These stocks, not elsewhere quoted, had the following range of prices during the week: (New York) Bamb. Delamar, 6⅛—5; Butte Coalition, 36¾—32½; Cumb. Ely Min., 8⅛—6⅞; Greene Gold-Silver, 4¼—3; Mont. Shoshone, 5¼—4⅜; Nevada Con. Copper, 20—17¾. (Boston) Adventure, 6¾—6⅛; Montana C. & C., 5⅛—4¼; Nevada, 19¾—17⅜; Trinity, 11—10; U. S. Oil, 12¼—12⅛; Wolverine, 144—135; Wyandotte, 1½—1⅜.

BOSTON.

Aliouez	39	37	37½	915
Amalgamated	109¼	103½	103⅛	36,637
Atlantic	23	21	21	1,415
Bingham	40¾	38	38	3,810
Boston Consolidated	25¼	20⅝	22⅛	46,880
*Calumet & Hecla	690	680	680	56
Centennial	26½	25	25	677
*Mercur	70	60	64	2,834
*Copper Range	80⅛	78¾	78¾	2,270
*Daly-West	15	14	14⅛	930
Franklin	20¼	18¾	18¾	1,361
Granby	13½	12⅞	12¾	4,151
Isle Royale	22⅛	22	22	230
Mass	9¼	8½	8⅜	1,037
Michigan	13¾	13⅛	13½	306
Mohawk	58½	57	57⅜	1,170
*North Butte	83	79½	79½	6,807
Old Dominion	45¾	44½	45	715
Osceola	102½	100	100	915
Parrot	37⅛	36	37	640
Quincy	92½	90	90	332
Rhode Island	6¼	5½	5½	435
Shannon	7¾	6⅞	7	6,427
Tamarack	108	108	108	36
Tecumseh	14	12½	13	320
United Copper, com.	72⅛	65	65	27,307
U. S. Smg. & Ref.	58	55	56	9,143
" " pfd.	46¼	44½	45¾	7,473
Utah	62¾	60¾	61	2,992
Victoria	9¼	8	8	2,105
Winona	10	9	9⅛	1,340

COLORADO SPRINGS.

Name of Company.	First	High	Low	Clg.
Elkton	41½	41½	39	40
El Paso	89⅛	98	88⅝	93
Isabella	27⅛	27⅜	26½	27
Portland	190	190	181	181
Vindicator	95	95	82½	92

SAN FRANCISCO.

Best & Belcher	1.15	1.15	1.05	1.10
Bullion	.35	.35	.28	.30
Caledonia	.44	.44	.37	.37
Confidence	.70	.70	.69	.70
Con. Cal. & Va	1.30	1.35	1.30	1.35
Gould & Curry	.15	.15	.12	.12
Hale & Norcross	1.35	1.35	1.25	1.25
Mexican	1.30	1.30	1.15	1.15
Occidental Con	.96	.96	.94	.94
Ophir	5.50	5.50	5.12½	5.12½
Savage	.63	.63	.56	.59

*Ex-dividend. †1st Installment Paid.
‡Assessment Paid. §2d Installment Paid.

Monthly Average Prices of Metals.

SILVER.

Month.	New York.		London.	
	1905.	1906.	1905.	1906.
January	60.690	65.288	27.930	30.113
February	61.023	66.10-	28.047	30.464
March	58.046	.....	26.794	.....
April	56.600	.....	26.108	.....
May	57.832	.....	26.664	.....
June	58.428	.....	26.910	.....
July	58.915	.....	27.163	.....
August	60.259	..	27.822	.....
September	61.695	.....	28.528	.....
October	62.034	.....	28.637	.....
November	63.849	.....	29.493	.....
December	64.850	.....	29.977	.....
Year	60.352	.....	27.839	.....

The New York prices are in cents per fine ounce; the London quotation is in pence per standard ounce, .925 fine.

COPPER.

	NEW YORK.				LONDON.	
	Electrolytic.		Lake.			
	1905.	1906.	1905.	1906.	1905.	1906.
Jan.	15.008	18.310	15.128	18.416	68.262	78.896
Feb.	15.011	17.869	15.136	18.116	67.963	78.147
March	15.125	.....	15.250	.....	68.174	.....
April	14.920	.....	15.045	.....	67.017	.....
May	14.627	.....	14.820	.....	64.875	.....
June	14.673	.....	14.813	.....	65.881	.....
July	14.888	.....	15.005	.....	66.887	.....
Aug.	15.664	.....	15.725	.....	69.830	.....
Sept.	15.965	.....	15.978	.....	69.667	.....
Oct.	16.279	.....	16.332	.....	71.406	.....
Nov.	16.599	.....	16.758	.....	74.727	.....
Dec.	18.328	.....	18.398	.....	78.993	.....
Year	15.590	.....	15.699	.....	69.465	.....

New York prices are in cents per pound. Electrolytic quotations are for cakes, ingots or wire bars. The London prices are in pounds sterling per long ton of 2,240 lb., standard copper.

TIN IN NEW YORK.

Month.	1905.	1906.	Month.	1905.	1906.
Jan.	29.325	36.390	July	31.760	....
Feb.	29.262	36.403	August	32.866	.....
March	29.523	.....	Sept	32.095	.....
April	30.525	.....	Oct	32.481	.....
May	30.049	.....	Nov.	33.443	.....
June	30.329	.....	Dec.	35.835	.....
			Av. year.	31.358	.....

Prices are in cents per pound.

LEAD IN NEW YORK.

Month.	1905.	1906.	Month.	1905.	1906.
Jan.	4.552	5.600	July	4.524	.....
Feb.	4.450	5.464	Aug.	4.665	.....
March	4.470	.....	Sept.	4.850	.....
April	4.500	.....	Oct.	4.850	.....
May	4.500	.....	Nov.	5.200	.....
June	4.500	.....	Dec.	5.422	.....
			Av., year.	4.707	.....

Prices are in cents per pound. The London average for January, 1906, was £ 16.850 per long ton; February, £ 16.031.

SPELTER.

Month.	New York.		St. Louis.		London.	
	1905.	1906.	1905.	1906.	1905.	1906.
Jan.	6.190	6.487	6.032	6.337	25.062	28.225
Feb.	6.139	6.075	5.989	5.924	24.594	25.844
Mar.	6.067	.....	5.917	.....	23.825	.....
April	5.817	.....	5.667	.....	23.813	.....
May	5.434	.....	5.284	.....	23.594	.....
June	5.190	.....	5.040	.....	23.875	.....
July	5.396	.....	5.247	.....	23.938	.....
Aug.	5.706	.....	5.556	.....	24.675	.....
Sept.	5.887	.....	5.737	.....	26.375	.....
Oct.	6.087	.....	5.934	.....	28.225	.....
Nov.	6.145	.....	5.984	.....	28.500	.....
Dec.	6.522	.....	6.374	.....	28.719	.....
Year.	5.882	.....	5.730	.....	25.433	.....

New York and St. Louis prices are in cents per pound. The London prices are in pounds sterling per long ton (2,240 lb.) good ordinary brands.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

(See also Market Reviews.)

ABRASIVES—		
Bort as to size	carat,	$10.00@$18.00
Carborundum, f.o.b. Niagara Falls, powd	lb.	.08
Grains	"	.10
Corundum, N. C.	"	.07@.10
Chester, Mass.	"	.04½@.05
Craigmont, Ont.	"	.05½@.06½
Mont. f.o.b. Chicago	"	.07@.07½
Crushed Steel, f.o.b. Pittsburg	"	.05½
Emery, in kegs: Turkish flour	"	.03½
Grains	"	.05@.05½
Naxos flour	"	.03½
Grains	"	.05@.05½
Chester flour	"	.03½
Grains	"	.05@.05½
Peekskill, f.o.b. Easton, Pa., flour	"	.01½
Grains, in kegs	"	.02½
Garnet, per quality	sh. ton	25.00@35.00
Pumice Stone, Am. Powd.	lb.	.01 3-5@.02
Italian, powdered	"	.01½@.01¾
Lump, per quality	"	.04
Rottenstone, ground	"	.02½@.04½
Lump, per quality	"	.06@.20
Rouge, per quality	"	.10@.30
Steel Emery, f.o.b. Pittsburg	"	.07
ACIDS—		
Acetic	lb.	.02¼ and up
Boric	"	.10@.11
Oxalic	"	.05¼@.05½
ALCOHOL—Grain	gal.	2.45@2.47
Refined wood, 95@97%	"	.70@.75
Purified	"	1.25@1.30
ALUM—Lump	100 lb.	1.75
Ground	"	1.85
Chrome Alum	lb.	0.05
ALUMINUM—Sulphate, com'l.	"	75@1.25
AMMONIUM—		
Bromide	lb.	.22
Carbonate	"	.08
Muriate grain	"	.05½@.06½
Lump	"	.09½
Sulphocyanide com.	"	.25
" " chem. pure	"	.35
ARSENIC—White (nominal)	"	.03½@.08
Red	"	.06½@.07
ASPHALTUM—		
Barbadoes	per ton.	20.00@100.00
West Indies	"	40.00@80.00
Egyptian	lb.	.10
Gilsonite, Utah ordinary	per ton.	40.00@60.00
Trinidad	"	26.00
California	"	20.00@25.00
BARIUM—		
Carb. Lump, 80@90%	sh. ton.	25.00@27.00
92@98%	"	28.00@29.00
Powdered, 80@90%	lb.	.01½@.02
Chloride com'l	ton.	34.00@36.00
Nitrate, powdered, in casks	lb.	.06
Sulphate (Blanc Fixe)	"	.02
BARYTES—		
Am. Crude	sh. ton.	11.00@13.00
Crude No. 2	"	13.00@15.00
Floated	"	17.00@19.00
Foreign floated	"	19.00@21.00
White	"	17.25@19.00
BISMUTH—Sub-nitrate	lb.	1.50
BLEACHING POWDER—35%,	100 lb.	$1.25@1,30
BONE ASH	lb.	.02½@.02½
BORAX	"	.07½@.07½
CALCIUM—Acetate, gray	"	2.35
Acetate, brown	"	1.60@1.65
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. works	"	9.00@10.00
CEMENT—		
Portland, Am. 500 lb.	bbl.	1.55@1.60
Foreign	"	1.25@1.75
"Rosendale," 300 lb.	"	.85
(in sacks)		.65
Slag cement	"	.75@1.25
CHROME ORE—		
(50%) ex-ship N. Y.	lg. ton.	18.50@19.00
Bricks, f.o.b. Pittsburg, M.	"	175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	"	7.50
Foreign	"	11.00
COBALT—Oxide	lb.	2.60
COPPERAS—Bulk	100 lb.	$0.47½
In bbls	"	.57½
In bags	"	.62½
CRYOLITE	lb.	.06½
EXPLOSIVES—		
Blasting powder, A	25-lb. keg	$2.65
Blasting powder, B	"	1.40
"Rackarock," A	lb.	.25
"Rackarock," B	"	.18
Judson R.R. powder	"	.10
Dynamite (20% nitro-glycerine)	"	.13
(30% nitro-glycerine)	"	.14
(40% nitro-glycerine)	"	.15
(50% nitro-glycerine)	"	.16½
(60% nitro-glycerine)	"	.18
(75% nitro-glycerine)	"	.21
Glycerine for nitro	"	.11@.11½
FELDSPAR—Ground	sh. ton.	9.75@10.00
FIRE BRICK.		
American	per M.	20.00@30.00
Imported	"	30.00@45.00
St. Louis No. 1	"	16.00
" No. 2	"	14.00
Extra	"	20.00@23.00
FIRE CLAY.		
St. Louis mill,	per ton	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	sh. ton.	8.00@10.00
Ground	"	11.50@13.50
Gravel	"	4.25@4.50
FULLER'S EARTH—Lump	100 lb.	.80
Powdered	"	.85
GRAPHITE—		
American, ore, common	lb.	.01@.10
Artificial	"	.06
Ceylon, common pulv	"	.02½@.03½
Best, pulverized	"	.04@.06
German, com. pulv	"	.01½@.01½
Best, pulverized	"	.01½@.02
Italian, pulverized	"	.01@.02
GYPSUM—Ground	sh. ton.	8.00@8.50
Fertilizer	"	7.00
Rock	lg. ton.	4.00
English and French	"	14.00@16.00
INFUSORIAL EARTH—		
Ground Am. best	"	20.00
French	"	37.50
German	"	40.00
LEAD—Acetate (sugar of)	lb.	.07½@.09½
Nitrate, com'l	"	.07½@.08
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	6.50@7.00
Calcined	sh. ton.	16.50@17.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	lb.	.01½
Sulphate (Glaubers salt)	100 lb.	.40@.50
MANGANESE—		
Crude powdered:		
70@75% binoxide	lb.	.01½@.01½
75@85% binoxide	"	.01½@.02½
85@90% binoxide	"	.02½@.03½
90@95% binoxide	"	.03½@.05½
Ore	unit.	.18@.20
MARBLE—Flour	sh. ton.	6.00@7.00
MINERAL WOOL—		
Slag, ordinary	"	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
Selected	"	40.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide	lb.	.10
NICKEL—		
Oxide, crude, 100 lb. (at .55 for fine metal contained.		.35@.40
Sulphate, single	100 lb,	.22@.25
" double	"	.13@.15
OZOKERITE	lb.	11½
PAINTS AND COLORS—		
Litharge, Am. powdered	"	.05½@.06½
English glassmakers'	"	.06½@.06½
Lithophone	"	.03½@.06½
Metallic, brown	sh. ton.	19.00
Red	"	16.00
Ocher, Am. common	"	8.50@9.00
Best	"	16.00
Dutch, washed	lb.	.02½
French, washed	"	.01½@.01½
Paris green, pure, bulk	"	(.12) nominal
Red lead, American	"	.06½@.06½
Foreign	"	.07@.08½
Turpentine, spirits	gal.	.64
White lead, Am., dry	lb.	.05½@.05½
American, in oil	"	.06½@.06½
Foreign, in oil	"	.09@.09½
Zinc white, Am. extra dry	"	.04½@.04½
Foreign, red seal, dry	"	.06@.08½
Green seal, dry	"	.06½@.09½
POTASSIUM—		
Bicarbonate crystal	lb.	$0 08½
Powdered or granulated	"	.14
Bichromate, Am	"	.08½@.08¾
Scotch	"	.08¼@.08½
Bromide	"	.16
Carbonate (80@85%)	"	.03½@.04½
Caustic, ordinary	"	.04½
Elect. (90%)	"	.05½@.06½
Chlorate, powdered	"	.09½ and up
Crystals	"	.08½@.09½
Cyanide (98@99%)	"	.18@.19
Kainit (bulk)	lg. ton.	8.50
Manure salt 20%	"	14.75@15.50
Double Manure Salt, 48@53%	100 lb.	1.16½@1.19½
Muriate	" "	1.95
Permanganate	lb.	.09½@.10
Prussiate, yellow	"	.13½@.13½
Red	"	.35
Sulphate	100 lb.	2.18½@2.21½
SALT—N. Y. com. fine 280 lb. bbl.		.72@1.18
N. Y. agricultural	sh. ton.	4.40
SALTPETER—Crude	100 lb.	4.25@4.50
Refined	"	4.50@5.50
SILICA—		
Ground quartz, ord'ry	sh. ton	9.00@10.00
Best	"	12.00@13.00
Lump Quartz	"	2.50@4.00
Glass sand	"	2.75
Infusorial earth, crude		25.00
Calcined and floated		32.00
SILVER—Nitrate, crystals	oz.	.42@.45½
SODIUM—		
Acetate	lb.	0.04¼
Bichromate	lb.	.07
Bromide	"	.42
Chlorate, com'l	"	.08½@.09½
Cyanide, ("100% KCN")	"	.18@.19
Hyposulphite, Am	"	1.50@1.60
German	"	1.75@2.00
Phosphate	lb.	.02½@.02½
Prussiate	"	.09½@.09½
Sal soda, f.o.b. works	100 lb.	.60
Foreign, f.o.b. N. Y.	"	.85
Silicate, concentrated	lb.	.05
Com'l	"	.01
Sulphate, com'l	100 lb.	.40
STRONTIUM—Nitrate	lb.	.09
SULPHUR—Best seconds, per ton,		22.25
Roll	100 lb.	1.85
Flour	" "	1.90
Flowers, sublimed	" "	2.20
TERRA ALBA—	100 lb.	.70@.80
TALC—Domestic	sh. ton.	15.00 and up
French, best	"	15.00@20.00
Italian, best	"	20.00 and up
TAR—Oil bbl. (50 gal.)	bbl.	5.40
TIN—Bi-chloride, 45%	lb.	.09¾
Crystals	"	.22
URANIUM—Oxide	"	2.25@3.00
ZINC—Metallic ch. pure	"	.07@.09½
Chloride solution, com'l	"	.02½
Chloride, granular	"	.04½@.04½
Dust	"	.05½@.05½
Sulphate	"	.02@.02½

The Rare Earths.

BORON—Nitrate	lb.	$1.50
CERIUM—Oxalate	oz.	.35
LITHIUM—Carbonate	"	1.50
LITHIUM—Nitrate	oz.	.60
TANTALUM—Acid	oz.	.40
Ore, 20% acid	lb.	.20
" 70% "	"	3.50
THORIUM—Nit. 49@50%	"	7.00@10.00
URANIUM—Nitrate	oz.	.25
ZIRCONIUM—Nitrate	lb.	10.00

Note—These quotations are for wholesale lots in New York, unless otherwise specified, and are generally subject to the usual trade discounts. Readers of THE ENGINEERING AND MINING JOURNAL are requested to report any corrections needed, or to suggest additions which they may consider advisable.